HEIDENHAIN

Evaluation Electronics

For Metrological Applications

April 2015

For many metrology applications, ranging from simple measuring stations to complex inspection systems with multiple measuring points, HEIDENHAIN supports you with compatible evaluation electronics.

The functionality always orients itself to the specific application. Whether it is an SPC inspection station, a tool presetter, a profile projector, a measuring microscope, or a manual coordinate measuring machine, the **evaluation electronics for metrological applications** from HEIDENHAIN are the right choice for measurement tasks. There is even a CNC option for the automation of measurement tasks.

Evaluation electronics for 2-D and 3-D measuring tasks

Digital readouts from HEIDENHAIN for manual machine tools optimally support the operator with well proven cycles for milling, drilling and turning. You can find these digital readouts on the Internet at www.heidenhain.de or in the *Digital Readouts and Linear Encoders for Manually Operated Machine Tools* product brochure.

Evaluation electronics for measuring and testing tasks

Comprehensive descriptions of all available interfaces as well as general electrical information are included in the *Interfaces for HEIDENHAIN Encoders* brochure, ID 1078628-xx.

You can download the operating instructions in the desired language free of charge from the HEIDENHAIN homepage.

This catalog supersedes all previous editions, which thereby become invalid. The basis for ordering from HEIDENHAIN is always the catalog edition valid when the contract is made.

Standards (ISO, EN, etc.) apply only where explicitly stated in the catalog.

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Selection guide
2-D and 3-D measuring tasks

	Monitor	Axes		Functions
		Length	Angle	
ND 100 QUADRA-CHEK Evaluation electronics for • Profile projectors • Measuring microscopes	Monochrome	2 (XY)	–	• Measurement of 2-D features • Point measurement with crosshairs • Graphic display of measurement results
		2 (XY)	1 (Q)	
		3 (XYZ)	–	
ND 1200 QUADRA-CHEK Evaluation unit for • Profile projectors • Measuring microscopes • 2-D measuring machines	Monochrome	2 (XY)	–	• Measurement of 2-D features • Measure Magic function • Point measurement with crosshairs • Programming of features and parts • Graphic display of measurement results
		2 (XY)	1 (Q)	
		3 (XYZ)	–	
		3 (XYZ)	1 (Q)	
ND 1300 QUADRA-CHEK Evaluation unit for • Profile projectors • Measuring microscopes • Video measuring machines	Color touchscreen	2 (XY)	–	• Measurement of 2-D features • Measure Magic function • Point measurement with crosshairs • Programming of features and parts • Graphic display of measurement results
		2 (XY)	1 (Q)	
		3 (XYZ)	–	
		3 (XYZ)	1 (Q)	
ND 1400 QUADRA-CHEK Evaluation unit for • Manual coordinate measuring machines	Color touchscreen	3 (XYZ)	1 (Q)	• Measurement of 2-D and 3-D features • Points measured via touch probe, crosshairs or rigid probing element • Measure Magic function • Programming of features and parts • Graphic display of measurement results • Five coordinate systems can be stored • Touch-probe management
IK 5000 QUADRA-CHEK Evaluation unit as the universal PC package solution for • Profile projectors • Measuring microscopes • Video measuring machines • Coordinate measuring machines	PC screen	3 (XYZ)	1 (Q)	• Measurement of 2-D and 3-D features (depending on the version) • Point measurement with crosshairs • Programming of features and parts • Graphic display of measurement results • Entry of tolerances • Import of CAD drawings for direct comparison • 3-D profiling (option; only with touch probe)
		3 (XYZ)	–	
		3 (XYZ)	1 (Q)	
		3 (XYZ)	1 (Q)	
		2 (XY)	1 (Q)	
		3 (XYZ)	1 (Q)	
		3 (XYZ)	1 (Q)	
		3 (XYZ)	1 (Q)	
ND 1200T TOOL-CHEK Evaluation unit for • Tool presetters	Monochrome	2 (XY)	–	• Point measurement with crosshairs • 99 tool adapters and 300 tools

	Options/Additional functions	Type	Page
	–	**ND 122**	**8**
		ND 123	
	Optical edge finder	**ND 1202**	**10**
		ND 1203	
	Optical edge finder upon request	**ND 1204**	
	• Optical edge finder • Video edge detection and live image display • Archiving and output of live images • Zoom and light control, programmable • NC axis control and autofocus	**ND 1302**	**12**
		ND 1303	
		ND 1304	
	–	**ND 1404**	**14**
	–	**IK 5294**	**16**
	3-D; touch probe	**IK 5293**	
	Optical edge detector	**IK 5394-EG**	
	3-D; zoom and light control; video evaluation; touch probe	**IK 5394-3D**	
	CNC; optical edge finder	**IK 5493**	
	CNC; video evaluation; zoom and light control; autofocus	**IK 5494-2D**	
	CNC; 3-D; video evaluation; touch probe; zoom and light control; autofocus	**IK 5494-3D**	
	CNC; 3-D; video evaluation; touch probe TP 200; zoom and light control; autofocus	**IK 5594**	
	–	**ND 1202T**	**20**

ND 100 QUADRA-CHEK

ND 1200 QUADRA-CHEK

ND 1300 QUADRA-CHEK

IK 5000 QUADRA-CHEK

ND 1200T TOOL-CHEK

Selection guide
Measuring and testing tasks

	Monitor	Axes		Functions
		Length	Angle	
ND 200 Evaluation unit for • Measurement equipment • Adjustment and inspection equipment • SPC inspection stations	Monochrome	1 (adjustable)		–
	Color	Up to 2 (adjustable)		• Metrology and statistical functions (sorting and tolerance checking, measurement series, SPC)
ND 1100 QUADRA-CHEK Evaluation electronics for • Positioning equipment • Measuring fixtures	Monochrome	2 (adjustable)		Measurement series with min./max. value storage
		3 (adjustable)		
		4 (adjustable)		
ND 2100G GAGE-CHEK Evaluation electronics for • Multipoint inspection apparatuses • SPC inspection stations	Color	4 (adjustable)		• Programming of up to 100 parts • Graphic display of measurement results • Sorting and tolerance checking using tolerance and warning limits • Measurement series with min./max. value storage • Entry of formulas and combinations • Functions for statistical process control (SPC)
		8 (adjustable)		
MSE 1000 Modular evaluation electronics for • Multipoint inspection apparatuses • SPC inspection stations	PC screen	Up to 250 (adjustable)		• Modular design • Configurable as desired • Various interfaces • Fast communication with higher-level computer system • Universal outputs
EIB 700 Evaluation electronics for • Testing stations • Multipoint inspection apparatuses • Mobile data acquisition	PC screen	4 (adjustable)		• Precise position measurement, up to 50 kHz updating rate • Programmable measured-value inputs • Internal and external measured-value triggers • Measured-value memory for approx. 250 000 measured values per channel • Connection over standard Ethernet interface to higher-level computer systems
IK 220 Evaluation electronics for installation in computer systems with PCI interface for • Measuring and testing stations	PC screen	2 (adjustable)		• Programmable measured-value inputs • Internal and external measured-value triggers • Measured-value memory for 8192 measured values per channel

	Options/Additional functions	Type	page
	–	**ND 280**	**Catalog: *Digital Readouts*** [1]
	Second encoder for sum/difference display, temperature compensation	**ND 287**	**22**
	Touch probes	**ND 1102**	**24**
		ND 1103	
		ND 1104	
	–	**ND 2104G**	**26**
		ND 2108G	
	–	**MSE 1000**	**28**
	Mounting bracket for 19-inch systems	**EIB 741** **EIB 742**	**32**
	Assemblies for encoder outputs and external inputs/outputs	**IK 220**	**34**

[1] Catalog *Digital Readouts and Linear Encoders for Manually Operated Machine Tools*

ND 287

ND 1100 QUADRA-CHEK

ND 2100G GAGE-CHEK

MSE 1000

EIB 741

IK 220

ND 100 QUADRA-CHEK
– The simple evaluation electronics for 2-D geometries

The ND 100s are evaluation units with two to three axes. They function as measuring computers for 2-D geometries. They are suited as entry-level readouts for optical comparators, measuring microscopes and 2-D measuring machines.

Execution
The ND 100 evaluation unit has a monochrome flat-panel screen for displayed values, dialogs and inputs, graphics functions and soft keys. With its sturdy housing and splash-proof membrane keyboard, the ND 100 is built for the workshop.

Functions
The appropriate combination of defined function keys and context-dependent soft keys always provides you with a clear overview. The innovative operator guidance provides self-explanatory information about the various functions. It already supports you while setting up the coordinate system (aligning the part and specifying the datum).

Predefined features (point, line, circle) are available for measurement. You can apply tolerance values to features and relationships. Only those tolerances actually possible are offered for the selected feature.

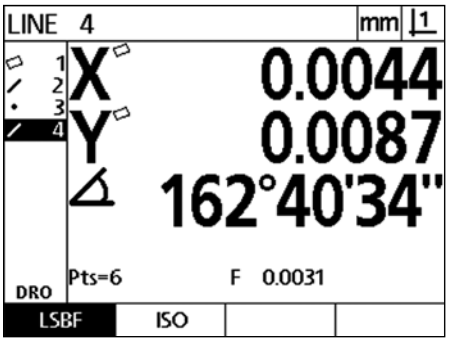
The ND 100 readouts measure points on plane (2-D) contours manually via crosshairs.

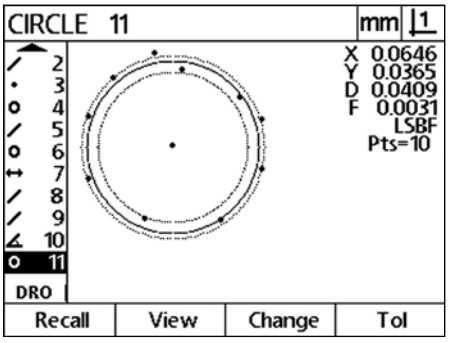
Data interfaces
A USB interface enables the evaluation unit to indicate measured values and import or export parameters and tables.

Graphic display
In addition to the position values, the ND 100 also displays the features graphically. Along with the individual measuring points, the geometrical and arithmetical deviations are also shown. Furthermore, for circles the maximum inscribed circles and minimum circumscribed circles are shown.

Tolerances
You can apply tolerance values to any feature. Only those tolerances actually possible are offered for the selected feature. This means that a point can only be assigned a tolerance check for its position, whereas a circle can be assigned position and shape tolerances.

Defining features
You can use the QUADRA-CHEK evaluation electronics to define features yourself. For example, this could be a circle whose position and dimensions are exactly defined, or an alignment line that is at a specified angle to a measurable line.





	ND 122	ND 123
Axes	2 (XY)	3 (XYZ or XYQ, configurable)
Encoder inputs Input frequency	⊓⊔ TTL ≤ 100 kHz	
Display step[1)]	*Linear axes:* 1 mm to 0.000 1 mm *Angular axis:* 1° to 0.0001° (00° 00′ 01″)	
Display	5.7″ color flat-panel display for position values, dialogs and inputs, graphic functions and soft keys	
Functions	• Measurement of two-dimensional features (2-D) • Point measurement with crosshairs • Graphic display of measurement results • Entry of tolerances • Measurement series with min./max. value storage	
Error compensation	• Linear, and segmented linear over up to 150 points • Squareness calibration • Matrix compensation over up to 30 x 30 points	
Data interface	• USB (type B)	
Accessories	Base, mounting arm, mounting frame	
Power connection	100 V to 240 V AC (–15 % to +10 %), 47 Hz to 63 Hz, ≤ 54 W	
Operating temperature	0 °C to 45 °C (storage temperature –20 °C to 70 °C)	
Protection EN 60529	IP 40, front panel IP 54	
Mounting	Tilting base or mounting arm (accessories)	
Weight	≈ 2.6 kg	

[1)] Depends on the signal period of the connected encoder as well as the subdivision factor

ND 1200 QUADRA-CHEK
– The evaluation electronics for 2-D geometries

The ND 1200 evaluation electronics can support up to four axes, and function as measuring computers for 2-D geometries. They are mainly suited to optical comparators, measuring microscopes and 2-D measuring machines.

Execution
The QUADRA-CHEK ND 1200 evaluation electronics have a monochrome flat-panel screen for displayed values, dialogs and inputs, graphics functions and soft keys. The robust, die-cast aluminum enclosure meets the demands of metrology and production control.

Functions
The appropriate combination of defined function keys and context-dependent soft keys always provides you with a clear overview. The innovative operator guidance provides self-explanatory information about the various functions. It already supports you while setting up the coordinate system (aligning the part and specifying the datum).

Predefined features (point, line, circle) are available for measurement. The "Measure Magic" function makes measurement particularly easy: it selects that feature which best matches the shape implied by the points probed. In addition, you can establish relationships (distances, angles) between features.

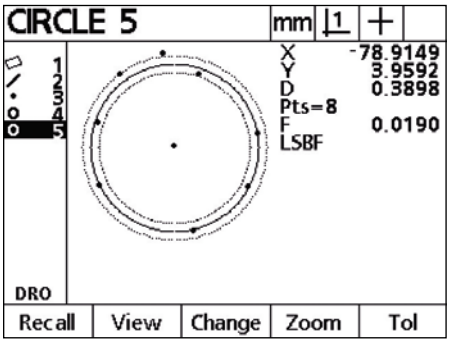
You can apply tolerance values to features and relationships. Only those tolerances actually possible are offered for the selected feature. You can create or automatically record measuring programs for repeated parts. The evaluation electronics graphically take you to the next measuring position during program run.

The ND 1200 captures measuring points of plane contours (2-D) either manually via crosshairs or, as an option, automatically via the optical edge finder.

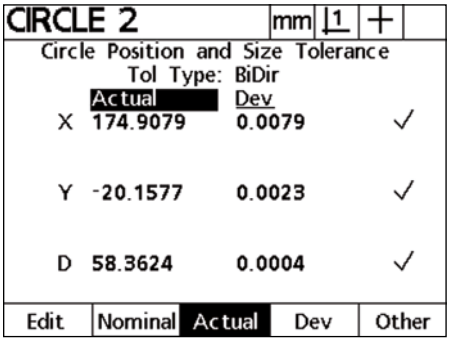
Data interfaces
You use the data interfaces to output measuring points as well as to read and transmit settings, compensation values and programs. The RS-232-C/V.24 serial interface enables communication with a PC. You can connect printers or memory media to the USB port.

A list of possible printers is available on the Internet at *www.heidenhain.de*

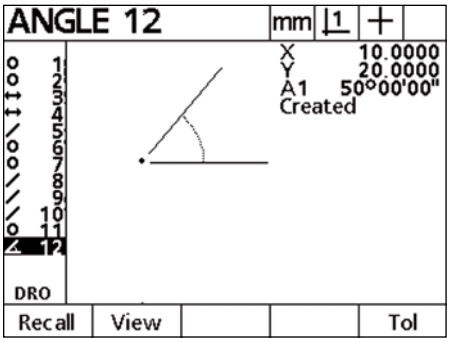
Graphic display
In addition to the position values, the ND 1200 also displays the features graphically. Along with the individual measuring points, the geometrical and arithmetical deviations are also shown. Furthermore, for circles the maximum inscribed circles and minimum circumscribed circles are shown.



Tolerances
You can apply tolerance values to any feature. Only those tolerances actually possible are offered for the selected feature. This means that a point can only be assigned a tolerance check for its position, whereas a circle can be assigned position and shape tolerances.

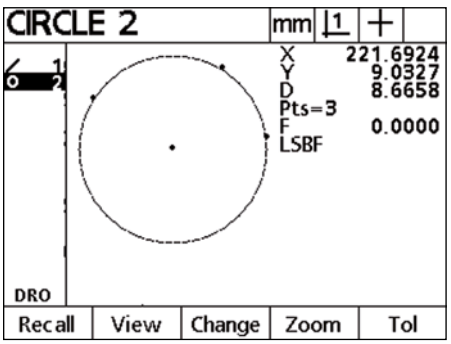


Defining features
You can use the QUADRA-CHEK evaluation electronics to define features yourself. For example, this could be a circle whose position and dimensions are exactly defined, or an alignment line that is at a specified angle to a measurable line.



Measure Magic
The Measure Magic function recognizes the geometric pattern based on the distribution of the measuring points, and automatically calculates which feature it is, such as a point, line or circle.

If the measuring points are poorly chosen, then it may not be possible to determine the feature unambiguously. Measure Magic then chooses the more common version. You can have the feature be displayed graphically, and then select from the possibilities.



	ND 1202	ND 1203	ND 1204
Axes*	2 (XY)	3 (XYQ) or 3 (XYZ)	4 (XYZQ)
Encoder inputs* Input frequency	∿ 1 V_{PP} or ⊓⊔ TTL (other interfaces available on request) ∿ *1 V_{PP}:* ≤ 275 kHz; ⊓⊔ *TTL:* ≤ 3 MHz		
Subdivision factor	10-fold (only for 1 V_{PP})		
Display step[1)]	Adjustable, max. 7 digits *Linear axes XYZ:* 1 mm to 0.0001 mm *Angular axis Q:* 1° to 0.0001° (00° 00′ 01″)		
Display	5.7″ color flat-panel display for position values, dialogs and inputs, graphic functions and soft keys		
Functions	• Measurement of two-dimensional features (2-D) • Point measurement with crosshairs • Programming of features and parts • Measure Magic: automatic recognition of geometries • Graphic display of measurement results • Entry of tolerances • Measurement series with min./max. value storage		
Edge finder*	Automatic point measurement via optical edge finder (option)		Upon request
Error compensation	• Linear, and segmented linear over up to 150 points • Squareness calibration • Matrix compensation over up to 30 x 30 points		
Data interface	• RS-232-C/V.24 • USB (type A)		
Other connections	• Foot switch for two functions, or remote keypad • Optical edge finder (only if the option is selected)		
Accessories	Foot switch, remote keypad, fiber-optic cables, holder, demo part, protective cover, tilting base, mounting adapter		
Power connection	100 V to 240 V AC (–15 % to +10 %), 47 Hz to 63 Hz, ≤ 100 W		
Operating temperature	0 °C to 45 °C (storage temperature –20 °C to 70 °C)		
Protection EN 60529	IP 00, front panel IP 40		
Mounting*	Tilting base or mounting base		
Weight	*ND with tilting base:* ≈ 4.8 kg; *ND with mounting adapter:* ≈ 2 kg		

***** Please select when ordering
1) Depends on the signal period of the connected encoder as well as the subdivision factor

ND 1300 QUADRA-CHEK
– The evaluation electronics for convenient 2-D measurement

The ND 1300 QUADRA-CHEKs are available in versions for up to four axes. They function as measuring computers with 2-D measurement of points, suiting them for measuring microscopes, measuring projectors and profile projectors, as well as for video measuring machines if the video edge detection option is installed.

Execution
The evaluation electronics of the ND 1300 series are characterized by the large color touchscreen. Their enclosures consist of robust, die-cast aluminum.

Functions
The innovative operator guidance provides self-explanatory information about the various functions. It already supports you while setting up the coordinate system (aligning the part and specifying the datum).

Predefined features (point, line, circle, slot and rectangle) are available for measurement. The "Measure Magic" function makes measurement especially easy. In addition, you can establish relationships (distances, angles) between features.

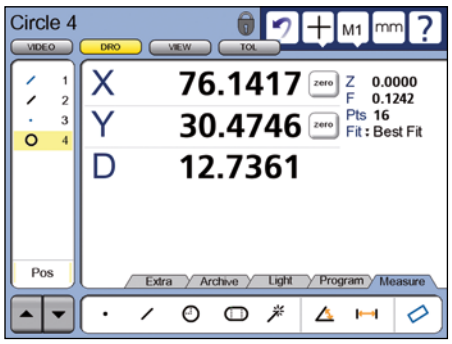
You can create or automatically record measuring programs for repeated parts. The evaluation electronics graphically take you to the next measuring position during program run.

Depending on the option installed, the ND 1300 probes the points of plane (2-D) contours either automatically or manually via crosshairs, optical edge detection, or a video camera. The integrated image processing function of the video option provides a special benefit: the video image is shown on the screen in real time, and can be saved and output via the data interface. The evaluation electronics even assume complete control of the illumination and the motor zoom.

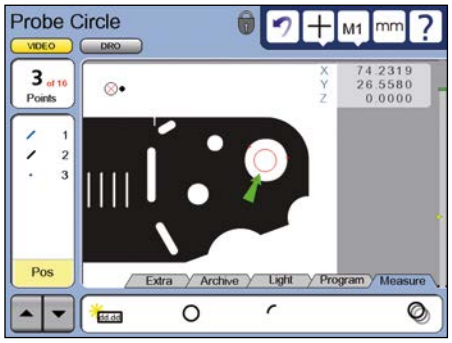
Data interfaces
You use the data interfaces to output measuring points as well as to read and transmit settings, compensation values and programs. The RS-232-C/V.24 serial interface enables communication with a PC. You can connect printers or memory media to the USB port.

A list of possible printers is available on the Internet at *www.heidenhain.de*

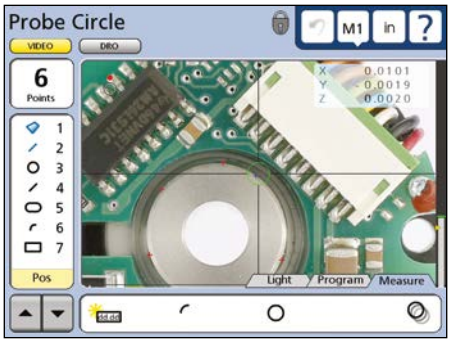
Clearly structured display
The large, color flat-panel touchscreen enables simple operation with intuitive operator guidance, since in each mode only those functions actually available are offered for selection. The numeric keypad and the few basic function keys are located in ergonomically favorable positions.



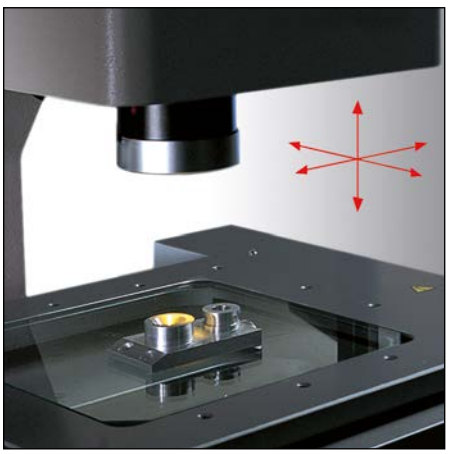
Point measurement
The ND 1300 readouts are designed for 2-D measurements. You are provided with various tools with which you can manually or automatically measure points. For automatic point measurement you simply move to the approximate position. The actual edge is automatically detected by the active tool (option). This objective point measurement permits a high degree of repeatability. This makes it possible for you to work quickly, reliably and effortlessly, while at the same time maintaining a low degree of measurement uncertainty.



Integrated image processing
The ND 1300 with video option optimally combines in one unit the functions of an evaluation electronics unit with the capability of displaying the image of the measured object directly on the screen. The separate PC with a frame grabber or monitor with crosshair generator that you would normally need is not necessary. Video cameras with S-Video or composite interfaces can be connected.



Axis positioning
The CNC option lets the ND 1300 work as a full-fledged control, directly controlling the positioning of the X, Y, Z and Q axes. Servo motors and stepper motors can be connected. Amplifiers with two or three axes for stepping motors are available as accessories.



	ND 1302	ND 1303	ND 1304
Axes*	2 (XY)	3 (XYQ) or 3 (XYZ)	4 (XYZQ)
Encoder inputs* Input frequency	⏦ 1 V_{PP} or ⊓⊔ TTL (other interfaces available on request) ⏦ *1 V_{PP}:* ≤ 275 kHz; ⊓⊔ *TTL:* ≤ 3 MHz		
Subdivision factor	10-fold (only for 1 V_{PP})		
Display step[1)]	Adjustable, max. 7 digits *Linear axes XYZ:* 1 mm to 0.0001 mm; *angular axis Q:* 1° to 0.0001° (00° 00′ 01″)		
Display	8.4″ color flat-panel display (touchscreen); resolution: SVGA 800 x 600 pixels, for position values, dialogs and inputs, graphics functions, soft keys, and display of video images with the *Video* option		
Functions	• Measurement of two-dimensional features (2-D) • Point measurement with crosshairs • Programming of features and parts • Measure Magic: automatic recognition of geometries • Tolerance display and graphic display of measurement results		
Edge finder***** (option)	• Automatic point measurement via optical edge finder		
Video***** (option)	• Automatic point measurement via video edge detection • Manual autofocus (only for Z axis) • Show live images • Archive and output live images (*Archive* option, only with the *Video* and *Zoom* options) • Zoom and light control, programmable (*Zoom* option, only with the *Video* and *CNC* options)		
CNC***** (option)	• Automation of measurement tasks • Axis control (for XYZQ) for servo and stepper motors • Autofocus via stepper-motor control		
Error compensation	• Linear, and segmented linear over up to 1000 points • Squareness calibration; matrix compensation over up to 30 x 30 points		
Data interface	RS-232-C/V.24; USB (type A)		
Other connections	• Foot switch for two functions • Video connection for S-Video and composite (*Video* option) • Light control over six light sources and zoom control (for *Video* and *Zoom* options) • CNC outputs and inputs for joystick (for *CNC* option)		
Accessories	Foot switch, fiber-optic cable, holder, amplifier, calibration standard, demo parts, protective cover, tilting base, mounting adapter		
Power connection	100 V to 240 V AC (–15 % to +10 %), 47 Hz to 63 Hz, ≤ 100 W		
Operating temperature	0 °C to 45 °C (storage temperature –20 °C to 70 °C)		
Protection EN 60529	IP 00, front panel IP 40		
Mounting*	Tilting base or mounting base		
Weight	*ND with tilting base:* ≈ 4.8 kg; *ND with mounting adapter:* ≈ 2 kg		

***** Please select when ordering; the options *Edge finder* and *Video* cannot be combined
1) Depends on the signal period of the connected encoder as well as the subdivision factor

ND 1400 QUADRA-CHEK

– The evaluation electronics for manual 3-D measuring machines

The ND 1400 QUADRA-CHEK evaluation unit supports four axes: in addition to the linear axes XYZ it features an auxiliary axis Q solely for angular display. The readout is designed specifically for manual coordinate measuring machines, and can capture two- and three-dimensional features with its measuring computer functionality.

Execution
The ND 1400 evaluation electronics are characterized by a large color touchscreen. Their enclosures consist of robust, die-cast aluminum.

Functions
The innovative operator guidance provides self-explanatory information about the various functions. It already supports you while setting up the coordinate system (ascertaining the reference plane, aligning the part and specifying the datum).

Predefined features (point, line, circle, slot, rectangle, plane, cylinder, cone, sphere) are available for measurement. The "Measure Magic" function makes measurement particularly easy: it selects that feature which best matches the shape implied by the points probed. In addition, you can establish relationships (distances, angles) between all features.

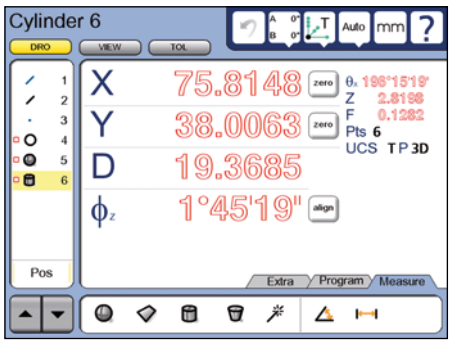
You can create or automatically record measuring programs for repeated parts. The evaluation electronics graphically take you to the next measuring position during program run.

You can also use the ND 1400 to measure 3-D features, such as surfaces, cylinders, cones, etc. The measuring points are probed with a touch probe. If a triggering touch probe is used, the values are transferred automatically. With rigid probing elements a key must be pressed.
The measured features can be clearly displayed either in three dimensions or in one of the three projection planes.

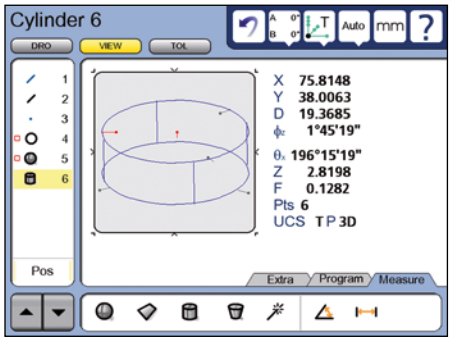
Data interfaces
You use the data interfaces to output measuring points as well as to read and transmit settings, compensation values and programs. The RS-232-C/V.24 serial interface enables communication with a PC. You can connect printers or memory media to the USB port.

A list of possible printers is available on the Internet at *www.heidenhain.de*

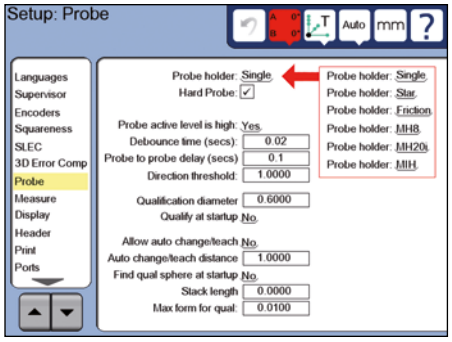
Clearly structured display
The large, color, flat-panel touchscreen enables simple operation with intuitive operator guidance, since in each mode only those functions actually available are offered for selection. The numeric keypad and the few basic function keys are located in ergonomically favorable positions.



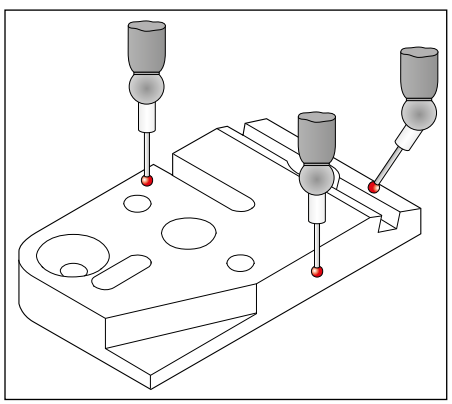
Measuring 3-D contours
In addition to the flat geometric features, such as points, lines, circles, etc., you can also use the ND 1400 to measure 3-D shapes, e.g. cylinders or cones. The screen displays the feature in three dimensions. Colored highlighting of each measuring point lets you identify form errors and any filtered measured values at a glance. The ND 1400 also permits 3-D position and form tolerances, such as flatness and parallelism.



Working with the touch probe
The ND 1400 also supports you optimally while working with touch probes. You can instantaneously call commercial probing elements (normal stylus, star stylus), as well as rigid and tiltable probing heads, all of which are managed in a library, via the touchscreen. During probing the ND automatically takes the direction of probing into account, as well as the length and diameter of the stylus. Even complex parts can be rapidly measured with the five available coordinate systems.



Point measurement
The ND 1400 probes the measuring points via the touch probe of the coordinate measuring machine. A triggering 3-D touch probe is connected directly to the evaluation electronics, and the measured value is transferred automatically. With a rigid probing element the measured value must be transferred by pressing a key. You can use the comprehensive input menu to define numerous parameters.



	ND 1404
Axes	4 (XYZQ)
Encoder inputs* Input frequency	⌒ 1 V_{PP} or ⊓⊔ TTL (other interfaces available on request) ⌒ *1 V_{PP}:* ≤ 275 kHz; ⊓⊔ *TTL:* ≤ 3 MHz
Subdivision factor*	10-fold (only for 1 V_{PP})
Display step[1)]	Adjustable, max. 7 digits *Linear axes XYZ:* 1 mm to 0.0001 mm *Angular axis Q:* 1° to 0.0001° (00° 00′ 01″)
Display	8.4″ color flat-panel display (touchscreen); resolution: SVGA 800 x 600 pixels, for position values, dialogs and inputs, graphics functions and soft keys
Functions	• Measurement of two-dimensional and three-dimensional features (3-D) • Points measured via crosshairs or rigid probing element • Automatic point measurement via touch probe • Programming of features and parts • Measure Magic: automatic recognition of geometries • Graphic display of measurement results, either three-dimensional or in the three projection planes • Entry of tolerances • Five coordinate systems can be stored • Touch-probe management for the various stylus shapes
Error compensation	• Linear, and segmented linear over up to 1000 points • Squareness calibration • Matrix compensation over up to 30 x 30 points
Data interface	• RS-232-C/V.24 • USB (type A)
Touch-probe connection*	HEIDENHAIN or Renishaw touch probe
Other connections	Foot switch for two functions
Accessories	Foot switch, 3-D demo part, protective cover, mounting adapter
Power connection	100 V to 240 V AC (–15 % to +10 %), 47 Hz to 63 Hz, ≤ 100 W
Operating temperature	0 °C to 45 °C (storage temperature –20 °C to 70 °C)
Protection EN 60529	IP 00, front panel IP 40
Mounting*	Tilting base or mounting base
Weight	*ND with tilting base:* ≈ 4.8 kg; *ND with mounting adapter:* ≈ 2 kg

***** Please select when ordering
1) Depends on the signal period of the connected encoder as well as the subdivision factor

IK 5000 QUADRA-CHEK

– The universal PC package solution for measuring machines

IK 5000 QUADRA-CHEK, the universal PC package solution for 2-D and 3-D measuring tasks, is equally suitable as initial equipment on a machine as well as for retrofitting. It is available in versions for three or four axes, and the optional expansions make it ready for all coordinate measuring technology applications and for video measuring microscopes. You can use it to measure two- and three-dimensional geometries and their relationships.

Execution

The IK 5000 QUADRA-CHEK consists of the IK 5000 slot card for the PC as well as the additional necessary slot covers and the corresponding PC software. Once installed on your PC you will have a powerful measuring station.

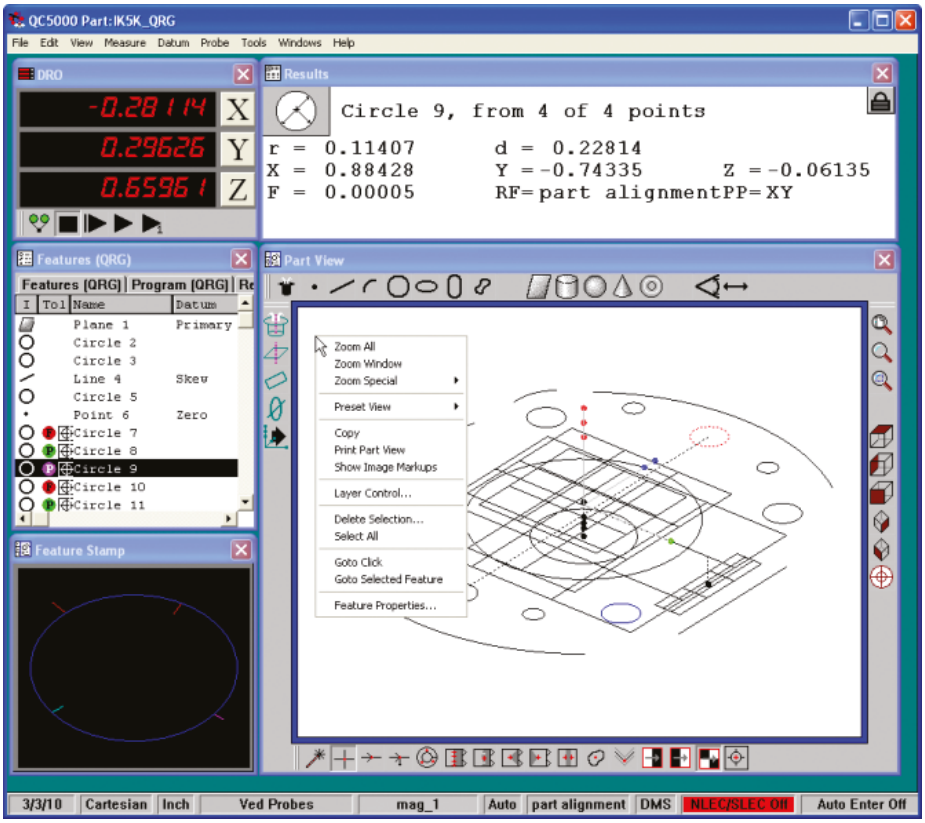
System requirements

The following is necessary for running QUADRA-CHEK (data for 3-D profiling option in italics):

- PC ≥ dual-core Pentium; 2.66 GHz (*quad core Pentium; 2.8 GHz*)
- Windows operating systems XP, Vista, 7 and 8 (32-bit/64-bit)
- RAM ≥ 1GB (*2 GB*)
- Hard disk: at least 500 MB (*1 GB*) available
- One PCI slot and one, two or three additional empty slots, depending on the version
- Screen:
  Resolution: at least 1024 x 768 pixels;
- Windows user rights: Administrator

Configuration

Various versions of the IK 5000 are available. Please see the configuration table for the model designations and various functions supported.



User interface

The IK 5000 QUADRA-CHEK screen shows various configurable windows and tool fields for clear and simple operation.

The **Part View** window shows the measured features with the accepted measuring points. You can also define relationships here.

The **Video** window (only in the version with video evaluation) shows the video image in real time.

The **Template** windows list all measured features, relationships and constructed features together with their values and tolerances in tables.

The feature currently being measured is shown in the **Feature Stamp** window. The **Results** window contains all corresponding information.

The **DRO** window shows you the current measuring position.

	IK 5294	IK 5293	IK 5394		IK 5493	IK 5494		IK 5594
Axes	**4** XYZQ	**3** XYZ	**4** XYZQ	**4** XYZQ	**3** XYQ	**4** XYZQ	**4** XYZQ	**4** XYZQ
2-D geometries	●	●	●	●	●	●	●	●
3-D geometries	–	●	–	●	–	–	●	●
Optical edge detector	–	–	●	–	●	–	–	–
Video evaluation	–	–	–	●	–	●	●	●
Zoom and light control	–	–	–	●	–	●	●	●
Autofocus	–	–	–	–	–	●	●	●
Touch probes	–	●	–	●	–	–	●	TP200
3-D profiling	–	Optional	–	Optional	–	–	Optional	Optional
CNC function	–	–	–	–	●	●	●	●

	IK 5000
Axes[1)]	3 (XYQ), 3 (XYZ) or 4 (XYZQ)
Encoder inputs* Input frequency	∿ 1 V_{PP} or ⊓⊔ TTL (other interfaces available on request) ∿ *1 V_{PP}:* ≤ 2 MHz; ⊓⊔ *TTL:* ≤ 3 MHz
Subdivision factor	Up to 100-fold, selectable via dip switch; default setting: 50-fold (only for 1 V_{PP})
Display step[2)]	Adjustable, max. 7 digits *Linear axes XYZ:* 1 mm to 0.0001 mm; *angular axis Q:* 1° to 0.0001° (00° 00′ 01″)
Display	By PC screen
Functions	• Measurement of two-dimensional features (2-D) • Measurement of three-dimensional features (3-D)[1)] • Point measurement with crosshairs • Programming of features and parts • Measure Magic: automatic recognition of geometries • Graphic display of measurement results • Entry of tolerances
Edge finder[1)]	• Automatic point measurement via optical edge finder
Video[1)]	• Automatic point measurement via video edge detection • Manual autofocus • Show live images • Archiving and output of live images • Zoom and light control, programmable (with the *Light/Zoom* versions) • Video connection for digital USB camera (with the *Video* versions) • Light control over six light sources and zoom control (with the *Video* and *Light/Zoom* versions)
CNC[1)]	• Automation of measurement tasks • Axis control (for XYZQ) for servo and stepper motors • Autofocus via stepper-motor control (Z axis) • CNC outputs and inputs for joystick
3-D profiling[1)] (option)	• Importing of CAD models • Probing of tested object and comparison with the CAD model • Flexible output of measurement results
Error compensation	• Linear, and segmented linear over any number of points • Squareness calibration • Matrix compensation over any number of points
Other connections	• Foot switch for two functions
Accessories	Foot switch, fiber-optic cables, holder for fiber-optic cables, amplifier, calibration standard, demo part, distribution cable
PC interface	PCI
Operating temperature	0 °C to 55 °C (storage temperature –30 °C to 70 °C)
Dimensions	100 mm x 250 mm

***** Please select when ordering
[1)] See the configuration table for possible combinations
[2)] Depends on the signal period of the connected encoder as well as the subdivision factor

IK 5000 QUADRA-CHEK
– Functions

The innovative operator guidance provides self-explanatory information about the various functions. It already supports you while setting up the coordinate system (aligning the part and specifying the datum).

Various predefined features are available for measurement, depending on the version:
2-D measurement: Point, line, circle, slot, rectangle
3-D measurement: Plane, cylinder, cone, sphere
The "Measure Magic" function makes measurement particularly easy: it selects that feature which best matches the shape implied by the points probed.

With IK 5000 QUADRA-CHEK you can define features yourself (for example, a circle whose position and dimensions are exactly specified). In addition, you can establish relationships (distances, angles) between features.

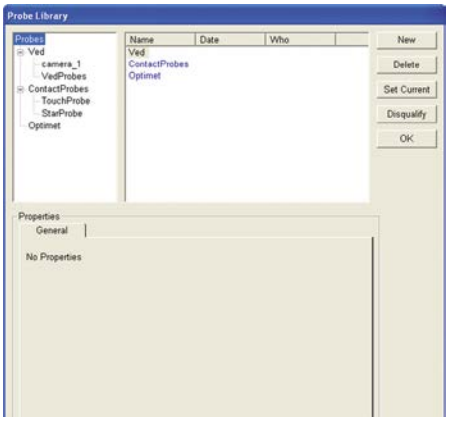
Measuring programs that you create yourself or record automatically simplify the efforts necessary for repeated parts. The evaluation electronics graphically take you to the next measuring position during program run.

Depending on the version, IK 5000 QUADRA-CHEK probes the measuring points of plane (2-D) contours either automatically or manually via crosshairs, via optical edge detection, or via a video camera.

For 3-D contours, such as planes, cylinders, cones and spheres, the measuring points are probed with a touch probe. If a triggering touch probe is used the values are transferred automatically. With rigid probing elements a key must be pressed.

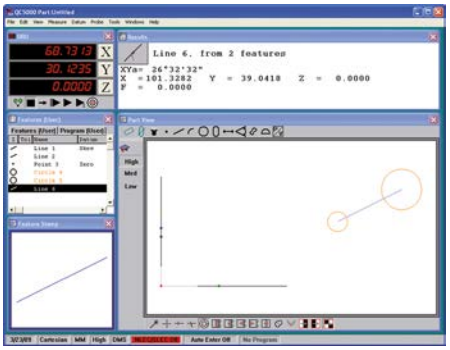
The measured features can be clearly displayed either in three dimensions or in one of the three projection planes.

Multi-sensor scanning
Along with the usual method for measuring points, the IK 5494 and IK 5594 versions permit multi-sensor scanning: in addition to the video camera, the measuring machine is also equipped with a touch probe. You can then use the touch probe to measure 3-D features on the object and enjoy the advantages of video evaluation for 2-D features. The integrated probe library manages the various measurement tools for you, whether they be optical, video, laser or touch-probe systems.



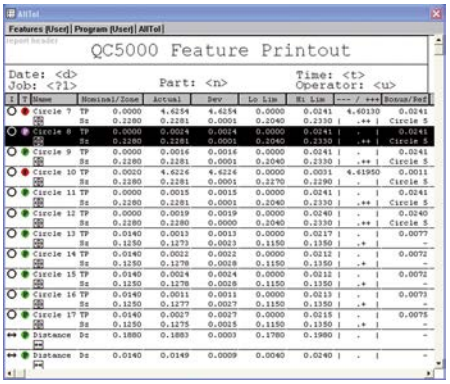
Constructed features
QUADRA-CHEK gives you several possibilities for determining dimensions:
- Measuring the features
- Calculating the features (e.g. the center point of a measured circle)
- Establishing a relationship between features (e.g. distance between two circle center points, angle between two lines)

However, you can also construct new features from existing features and from relationships. The properties of these constructed features can then be seen directly in the parts view.

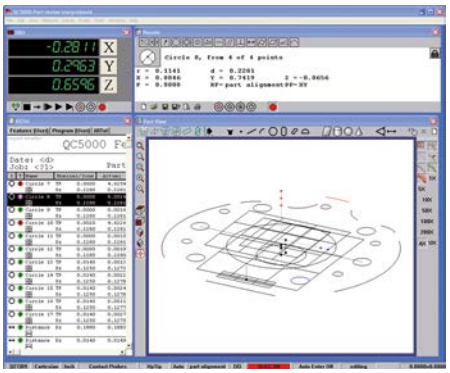


Data management
The integrated data-report generator for customized forms, databases and tolerance checks is used to archive, export and import data in numerous formats. Use the integrated spreadsheets for complex and non-standard calculations.

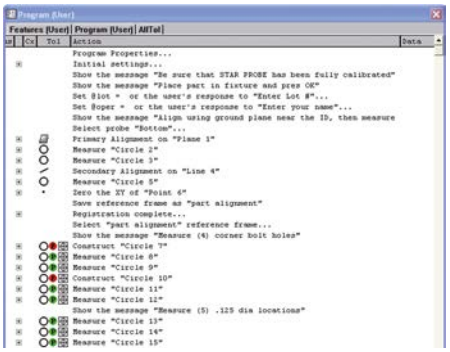
Simply send your customized reports to a printer, or make the data available to other users in a database.



Functional Part View window
QUADRA-CHEK provides you with a comprehensive, graphical Part View window. You can choose between a 3-D view, or a projection in the XY, YZ or ZX planes. Additionally, you can magnify, reduce, zoom, shift or rotate the views. You can define tolerances and constructed features in any view. The "pass/fail" color coding makes it easy to determine whether the part matches the specifications.

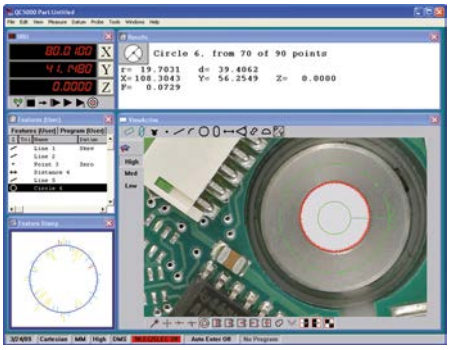


Programming of parts
Difficult and repetitive measuring tasks can be simplified with the aid of a program that you either create yourself or record automatically during measurement of the first part. QUADRA-CHEK learns the reference points, the sequence of measurements, tolerances and data-output commands. QUADRA-CHEK visually leads you to the features to be probed when the program is run. The program view also provides you with an optimum overview of the process.



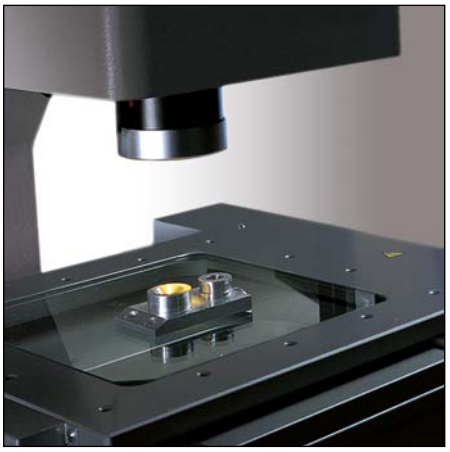
Integrated image processing
The integrated image processing function in versions with the video option provides a special benefit: the video image is shown on the screen and saved in real time. QUADRA-CHEK can even assume complete control of the illumination and the motor zoom. A digital USB camera can be connected.

In order to quickly and directly compare the actual status and nominal status, import the parts drawing in DXF or IGES format, and place it over the video image.

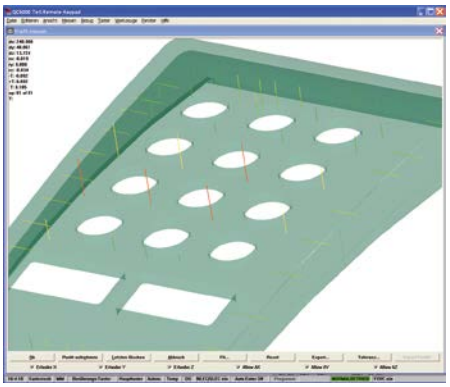


Axis positioning
The CNC versions of IK 5000 QUADRA-CHEK work as full-fledged controls, directly controlling the positioning of the X, Y, Z and Q axes. Servo motors or stepper motors can be connected. Amplifiers with two or three axes for stepping motors are available as accessories.

Automating
Programs running in combination with the CNC function of IK 5000 QUADRA-CHEK run automatically. This minimizes the effects of subjective assessments, and increases data throughput noticeably. By automating series of measurements and complex procedures, you spare yourself the strain of performing repetitive measuring tasks.

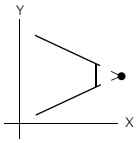


3-D profiling
The 3-D profiling option simplifies the measurement and evaluation of 3-D contours on multi-sensor and tactile measuring machines: First you import the CAD model, then you measure the real part, and finally you use the 3-D profiling function to compare the measured points with the CAD model. The measurement results are displayed graphically and can be managed in the usual manner. They can also be transferred to other quality systems.

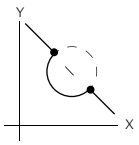


Examples of design capabilities:

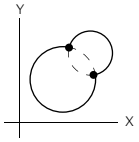
2-D possibilities



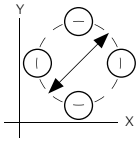
Intersection of two lines



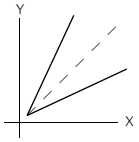
Intersection of line and circle



Intersection of two circles

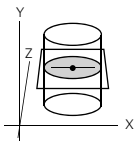


Bolt hole circle formed from three or more circles

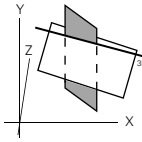


Bisector of two lines

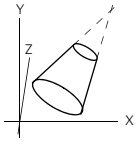
3-D possibilities



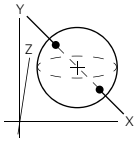
Intersection of cylinder and surface



Plane from plane and 3-D line



Taper angle



Intersection of sphere and line

ND 1200 T TOOL-CHEK
– The evaluation unit for tool presetters

The TOOL-CHEK ND 1200 T evaluation unit is designed specifically for tool presetters. It supports the X and Z axes.

Execution
The ND 1200 T features a monochrome flat-panel display. The robust, die-cast aluminum enclosure meets the demands of production floors.

Functions
The self-explanatory user guidance of the TOOL-CHEK ND 1200 T evaluation unit provides you with optimum support for all functions.

You can define up to 99 tool adapters for the tool holder. You can select either an absolute reference point, or one that refers to a master adapter. You can define the axis assignment and counting direction separately for each adapter.

Tool measurement usually consists of measuring the length and diameter or radius of a tool. You can also measure radii (e.g. for ball-nose cutters) and angles (e.g. for indexable inserts or lathe tools). The ND 1200 T stores up to 300 tools. You can respectively show and print each actual value, nominal value and deviation.

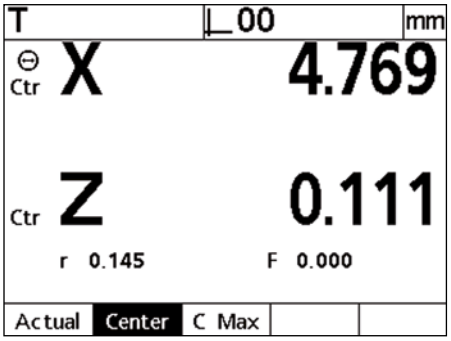
You can group various tools, e.g. those that are necessary for machining a certain part. Create this setup plan either by selecting the tools from the tool list, or by measuring each tool.

For tools that are too large to be shown on the projector, such as teeth with a radius, you can freeze an axis for measurement. If a tool has more than one tooth, then you use the incremental function to ascertain the tool data in reference to the master tooth as well.

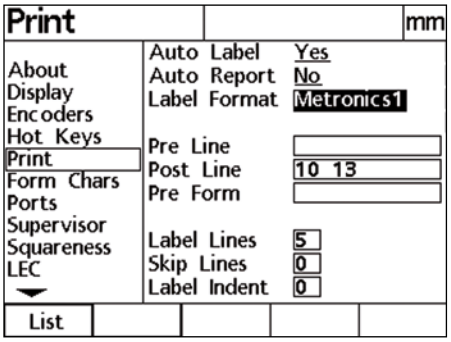
Data interfaces
You use the data interfaces to transmit the tool data and to import and export settings, compensation values and saved tools. The RS-232-C/V.24 serial interface enables communication with a PC. You can connect printers or memory media to the USB port.

A list of possible printers is available on the Internet at *www.heidenhain.de*

Measuring radii and angles
You probe several points with the cross-hairs in order to measure the radius. The evaluation electronics calculate the radius and any form error from this. In order to measure a cutting edge angle, probe the two sides of the angle at two points each. The results are the intersection of the two lines as well as the inside angle "A."



Label printing
You can connect various label printers via the USB port. The control commands necessary for this are already set, and can be called via the menu function.



Tool list
You can also store the data of all measured and numbered tools, and even print this data in a clearly structured list. Use the menu to specify which information is included in the list.

Tool list: Temp

TOOL-#	SG	POT	Z-ACT.	X-ACT.	Z-NOM.	X-NOM.	Z-DEV.	X-DEV.	R/D	I/MM
10	01	4	100.1000	28.1000	0.0000	0.0000	100.1000	28.1000	D	mm
20	01	5	100.1400	29.9400	0.0000	0.0000	100.1400	29.9400	D	mm
30	01	6	99.9400	29.4600	0.0000	0.0000	99.9400	29.4600	D	mm
40	01	7	100.1200	29.8000	0.0000	0.0000	100.1200	29.8000	D	mm
50	01	8	100.1500	29.5600	0.0000	0.0000	100.1500	29.5600	D	mm
60	01	10	99.8800	30.2000	0.0000	0.0000	99.8800	30.2000	D	mm

	ND 1202T
Axes	2 (XZ)
Encoder inputs* Input frequency	∿ 1 V_{PP} or ⊓⊔ TTL (other interfaces available on request) ∿ *1 V_{PP}:* ≤ 275 kHz; ⊓⊔ *TTL:* ≤ 3 MHz
Subdivision factor*	10-fold (only for 1 V_{PP})
Display step[1)]	Adjustable, max. 7 digits *Linear axis:* 1 mm to 0.0001 mm *Angular axis:* 1° to 0.0001° (00° 00′ 01″)
Display	5.7″ monochrome flat-panel display for position values, dialogs and inputs, and soft keys
Functions	• Point measurement with crosshairs • 99 tool adapters • Memory for 300 tools • Counting direction and axis assignment depend on the adapter • Radius/diameter switching • Entry of tolerances • Circle and angle measurement
Error compensation	• Linear, and segmented linear over up to 30 points • Parallelism error
Data interface	• RS-232-C/V.24 • USB (type A)
Other connections	Foot switch for two functions, or remote keypad
Accessories	Foot switch, remote keypad, protective cover, tilting base, mounting adapter
Power connection	100 V to 240 V AC (–15 % to +10 %), 47 Hz to 63 Hz, ≤ 100 W
Operating temperature	0 °C to 45 °C (storage temperature –20 °C to 70 °C)
Protection EN 60529	IP 00, front panel IP 40
Mounting*	Tilting base or mounting base
Weight	*ND with tilting base:* ≈ 4.8 kg; *ND with mounting adapter:* ≈ 2 kg

***** Please select when ordering
1) Depends on the signal period of the connected encoder as well as the subdivision factor

ND 287
– The evaluation unit for measuring and testing stations

Thanks to its wide range of functions, the ND 287 evaluation unit for one axis is predestined for measuring and inspection stations, but is also intended for simple positioning tasks. The universal encoder input permits connection of all incremental encoders with 11 μA_{PP} and 1 V_{PP} and absolute encoders with the EnDat 2.2 interface from HEIDENHAIN.

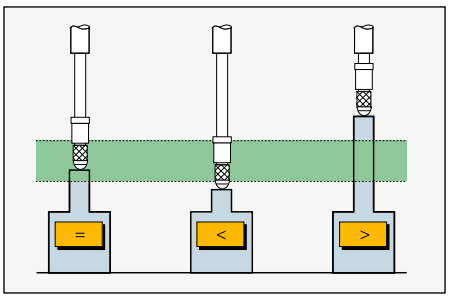
Execution
The ND 287 features a sturdy aluminum die-cast housing. A graphic TFT monitor displays the measured values, the status and the soft-key row. The splash-proof full-travel keyboard is built for the workshop.

Functions
The **ND 287** features numerous functions for measuring and processing individual positions, for example sorting and tolerance check mode, minimum/maximum value storage, measurement series storage. These data make it possible to calculate mean values and standard deviations and display them in histograms or control charts. With its modular design, the ND 287 permits connection of a second encoder for sum/difference measurement or of an analog sensor, for example for temperature compensation. The **ND 280** was conceived to perform simple measuring and positioning tasks (see the catalog *Digital Readouts and Linear Encoders for Manually Operated Machine Tools*).

Data interfaces
The ND 287 has serial interfaces for measured value transfer to a PC or printer, for input/output of parameters and compensation value lists, and for diagnostics:
- USB
- RS-232-C/V.24
- Ethernet 100BaseT (option)

The measured value transfer can be started at the ND keyboard, through an external command, through the RS-232-C/V.24 software command CTRL B, or by an adjustable internal clock.

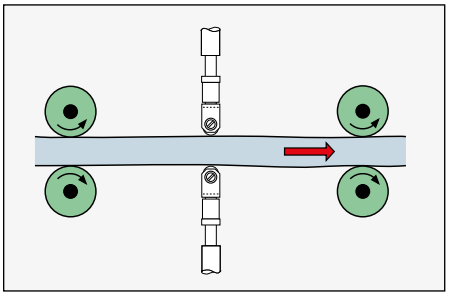
Sorting and tolerance checking
With the sorting function of the ND 287, workpieces can be inspected for dimensional accuracy and divided into classes. The result is indicated in the status display in color or with symbols; in addition, a corresponding signal is available at the switching outputs.



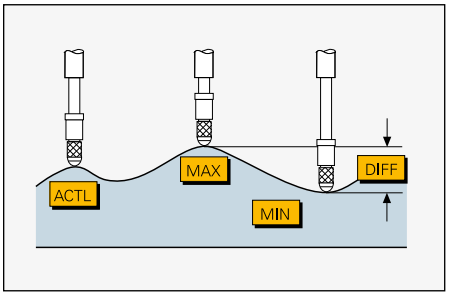
Sorting and tolerance checking

Display freeze
To be able to read the display reliably in spite of quickly changing values you can send an external signal to hold the display. The true position value is counted internally.

Combination with a second encoder
A second encoder or a sensor on the ND 287 can be connected through an optional **encoder module** or **analog module** input assembly. The data from two encoders can be combined through mathematical operands. The result and the two measured values are saved. This permits further areas of application, such as the sum/difference display of two encoders or temperature compensation through a temperature sensor.

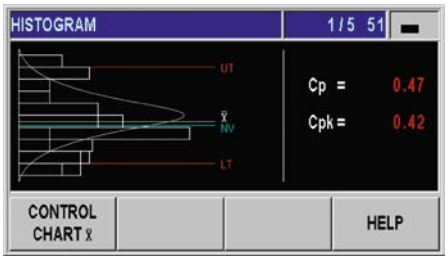

Sum measurement

Recording and evaluating series of measurements
The ND 287 provides a measured-value memory for recording series of measurements. The measurement value, minimum, maximum or difference can be displayed during the serial measurements. In addition, the displayed value can be checked with the classification function for compliance to tolerances. The saved measured values are evaluated and represented as:
- Statistical view (mean value, x standard deviation s, range r)
- Diagram (graphical display of the measured values with minimum/ maximum and mean values as well as tolerance limits)
- Measured value overview as a table



Measured value acquisition

Statistical process control (SPC)
For SPC, the ND 287 saves up to 1000 measured values in a nonvolatile FIFO memory. They are evaluated with the following functions:
- Statistical view of measured values in the FIFO memory
- Measured value overview as a table
- Diagram of the last 30 measured values
- Histogram in ten classes with probability density function and process capability indexes cp and cpk.
- Control charts for mean value x, standard deviation s, and range r



	ND 287
Axes	1; option: second input through encoder module
Encoder inputs Input frequency	∿ 1 V_{PP}; ∿ 11 μA_{PP} or EnDat[1] (automatic interface detection) ∿ *1 V_{PP}:* ≤ 500 kHz; ∿ *11 μA_{PP}:* ≤ 100 kHz
Subdivision factor	4096-fold
Display step[2]	Adjustable, max. 9 decades *Linear axis:* 0.5 µm to 0.002 µm; *angular axis:* 0.5° to 0.000 01° (00° 00′ 00.1″)
Analog input	Option: ±10 V through analog module; resolution 5 mV
Display	Color flat-panel display for position values, dialogs and inputs, graphic functions and soft keys
Functions	• REF reference-mark evaluation for distance-coded or single reference marks • 2 reference points • Distance-to-go mode • Remote operation via serial interface • Sorting and tolerance checking • Measurement series with min./max. value storage • Saving measured values (max. 10 000) • Functions for statistical process control (SPC) • Graphic depiction of distribution/histogram • Sum/difference counter (with 2nd encoder module) • Thermal compensation (with analog module)
Axis-error compensation	*Linear axis:* Linear and multipoint over up to 200 points *Angle axis:* Multipoint linear with 180 compensation points (every 2°)
Data interface	RS-232-C/V.24; USB (type B); option: Ethernet 100BaseT, over Ethernet module
Switching outputs For tasks in automation	• Zero crossover; trigger points 1 and 2 • Sorting signals "<" and ">" • Error
Switching inputs For tasks in automation	• Zero reset, preset • Cross over reference point and ignore reference signals • Measured value output or display freeze • Start measurement series • Minimum/maximum/difference display • Gating of the two encoder inputs • Sum or difference display • Display measured value 1 or measured value 2
Accessories	Mounting adapter, encoder module, analog module, Ethernet module
Power connection	100 to 240 V AC (–15 % to +10 %), 48 Hz to 62 Hz; 30 W
Operating temperature	0 °C to 50 °C (storage temperature –40 °C to 85 °C)
Protection EN 60529	IP 40, front panel IP 54
Weight	≈ 2.5 kg

[1] Purely serial, no evaluation of the incremental signals
[2] Depends on the signal period of the connected encoder (display step ≈ signal period/4096)

ND 1100 QUADRA-CHEK
– The evaluation unit for simple positioning tasks

The ND 1100 QUADRA-CHEK evaluation units can support up to four axes. They are mainly suited to positioning tasks on positioning equipment and measuring fixtures, as well as for retrofitting on measuring machines for data acquisition and relaying to a PC.

Execution
The ND 1100 QUADRA-CHEK evaluation electronics have a monochrome flat-panel screen for displayed values, dialogs, inputs and soft keys. The robust, die-cast aluminum enclosure meets the demands of metrology and production control.

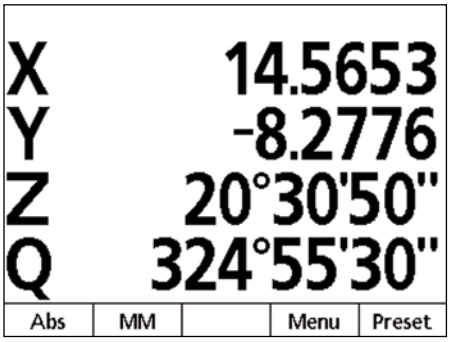
Functions
The logical placement of the function keys and soft keys permits innovative operator guidance, which supports you when using the diverse functions.

Along with the usual functions of evaluation electronics, such as zeroing and setting of reference values, the ND 1100 QUADRA-CHEKs have numerous other useful functions:
- Each axis can be configured for linear or angular display
- Minimum/maximum value storage
- Simple switching between counting directions
- Continuous data output via internal clock, or upon probing

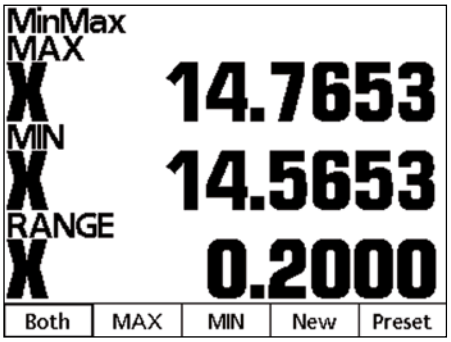
Data interfaces
You use the data interfaces to output measured points as well as to save settings and compensation values. The ND 1100 has an RS-232-C/V.24 serial interface for communication with a PC. You can connect printers or memory media directly to the USB port.

A list of possible printers is available on the Internet at *www.heidenhain.de*

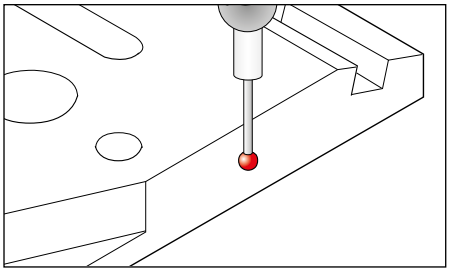
Display format
Depending on the type of encoder connected, you can define linear or angular display individually for each axis.



Minimum/maximum value storage
The ND 1100 is capable of minimum/maximum value storage in any selectable axis. The largest and smallest measured values of a measurement series as well as the difference are stored and can be output via the data interface. This function is especially advantageous during concentricity testing.



Touch-probe connection
The ND 1100 units feature a connection for touch probes (e.g. from HEIDENHAIN or Renishaw). The evaluation unit automatically reads the current position value during probing, and also takes the radius of the stylus into account.



Output format of measured values
Since the universal output formats are used by various manufacturers of measuring machines, the ND 1100 can easily be retrofitted as a data logger to manually operated measuring machines. The measured values are captured by the ND and then relayed to a connected PC for further processing.

```
X   12.3553 mm
Y   -8.2006 mm
Z   20.30.50 dms
Q   326.37.30 dms
```

	ND 1102	ND 1103	ND 1104
Axes	2	3	4
Encoder inputs* Input frequency	⌒ 1 V_{PP} or ⊓⊔ TTL (other interfaces available on request) ⌒ *1 V_{PP}:* ≤ 275 kHz; ⊓⊔ *TTL:* ≤ 3 MHz		
Subdivision factor	10-fold (only for 1 V_{PP})		
Display step[1)]	Adjustable, max. 7 digits *Linear axis:* 1 mm to 0.0001 mm *Angular axis:* 1° to 0.0001° (00° 00′ 01″)		
Display	5.7″ monochrome flat-panel display for position values, dialogs and inputs, and soft keys		
Functions	• Measurement series with min./max. value storage • Difference between minimum and maximum (range) • Scaling factor		
Error compensation	• Linear, and segmented linear over up to 300 points • Squareness calibration		
Data interface	• RS-232-C/*V.24* • USB (type A)		
Touch-probe connection*	HEIDENHAIN or Renishaw touch probe		
Other connections	Foot switch for two functions, or remote keypad		
Accessories	Foot switch, remote keypad, protective cover, tilting base, mounting adapter		
Power connection	100 V to 240 V AC (–15 % to +10 %), 47 Hz to 63 Hz, ≤ 100 W		
Operating temperature	0 °C to 45 °C (storage temperature –20 °C to 70 °C)		
Protection EN 60529	IP 00, front panel IP 40		
Mounting*	Tilting base or mounting base		
Weight	*ND with tilting base:* ≈ 4.8 kg; *ND with mounting adapter:* ≈ 2 kg		

***** Please select when ordering
1) Depends on the signal period of the connected encoder as well as the subdivision factor

ND 2100 G GAGE-CHEK
– The evaluation unit for multipoint inspection apparatuses

The ND 2100 G GAGE-CHEKs are versatile metrology displays for measuring and inspection tasks in manufacturing and quality assurance. With inputs for up to eight encoders, they are predestined for multipoint measurements from simple pass/fail detection up to complex SPC evaluation.

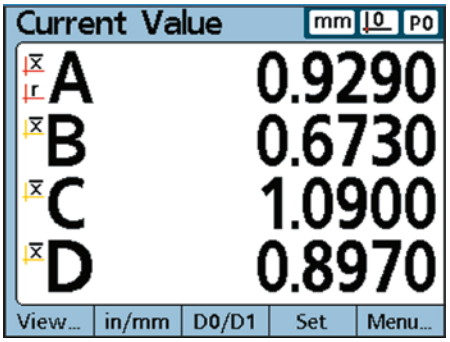
Execution
The ND 2100 G evaluation units have a robust, die-cast aluminum enclosure, and a keyboard suited to their environment. A large, graphic, color screen displays the measured values, the soft-key row and other information.

Functions
The inputs can be assigned and combined as desired with mathematical, trigonometric or statistical formulas. This makes it possible to measure even complex dimensions such as thickness, flatness, volume and more. The results are displayed numerically or graphically as a color bar graph or a dial, or archived for statistical process control (SPC). The GAGE-CHEK can be configured for basic or advanced applications. Soft keys and hot keys can be adapted as required. The minimum/maximum function of the ND 2100 G evaluation unit monitors and stores the highest and lowest measured or calculated value. Warning and tolerance limits can be assigned to each display value. Results outside of the tolerance are marked with a different color. An acoustic alarm sounds simultaneously. Tolerance values, SPC parameters and custom formulas are stored for individual parts. GAGE-CHEK can manage up to 100 parts, each with up to 16 visible measurement features and 16 hidden measurement features. The rapid acquisition of measurement data makes monitoring dynamic events, such as the eccentricity of a rotating shaft, possible.

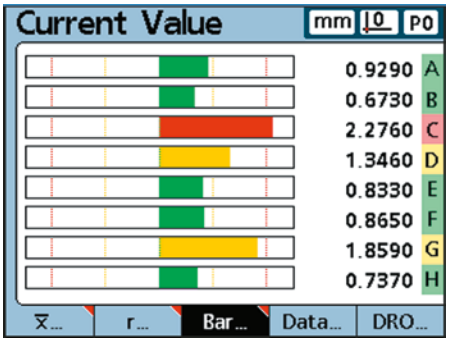
Data interfaces
The GAGE-CHEK features various interfaces for communicating with parent systems:
- RS-232-C/V.24 for PCs, also for remote operation of the GAGE-CHEK
- USB

A list of possible printers is available on the Internet at *www.heidenhain.de*

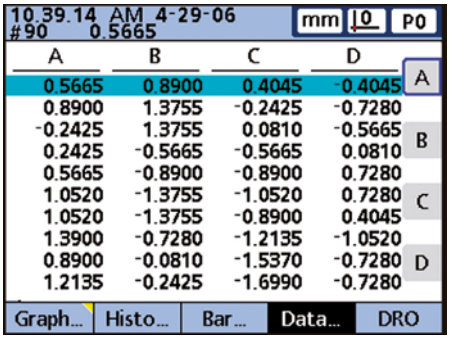
DRO view
The display values appear in large, easy-to-read numbers. Values outside the tolerance are color-coded, immediately notifying you of errors.



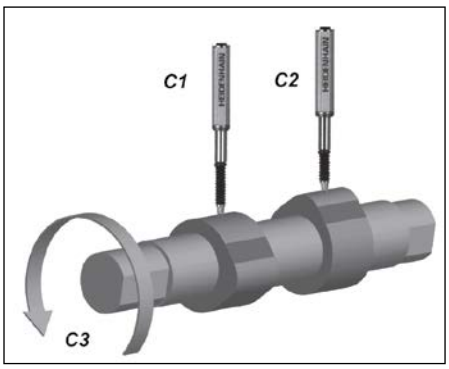
Bar diagram
You can select to have the values shown as a color-enhanced vertical or horizontal bar graph. The defined warning limits and tolerance limits provide instant feedback. If these limits are exceeded, the color of a bar changes from green to yellow or red, informing you explicitly of critical dimensions.



SPC and data storage
GAGE-CHEK includes integrated SPC studies such as mean value charts (X bar) and range charts (R). Min, max, sigma, cp and cpk are also calculated, and are clearly displayed as a graph or histogram. Historical raw data can be saved in a tabular numeric display. Each dimension and all data are time and date stamped.



Formulas and combinations
You can use mathematical and trigonometric formulas, as well as logical conditions, to combine individual measured values or measurement sequences with each other, and so create complex calculations. This can be used, for example, to calculate and display the circumference of a turned part, the volume of a cube, or the angle between two cams, and also to assign tolerance limits to these values.



	ND 2104G	ND 2108G
Axes	4	8
Encoder inputs* Input frequency	∿ 1 V_{PP}, ⊓⊔ TTL or EnDat 2.2 (other interfaces available on request) ∿ *1 V_{PP}:* ≤ 275 kHz; ⊓⊔ *TTL:* ≤ 3 MHz	
Subdivision factor	10-fold (only for 1 V_{PP})	
Display step[1)]	Adjustable, max. 7 digits *Linear axis:* 1 mm to 0.000 01 mm *Angular axis:* 1° to 0.0001° (00° 00′ 01″)	
Display	5.7″ color flat-panel display for position values, dialogs and inputs, graphic functions and soft keys	
Functions	• Part programming of up to 100 parts • Graphic display of measurement results • Sorting and tolerance checking using tolerance and warning limits, with display as a bar graph • Measurement series with min./max. value storage • Mathematical and trigonometric formulas • Functions for statistical process control (SPC) • Graphic display of measurement results and distribution • Data storage of values and formulas • Convenient diagnostics of the connected encoders (only EnDat 2.2)	
Error compensation	• Linear, and segmented linear over up to 60 points	
Data interface	• RS-232-C/V.24 • USB (type A)	
Switching inputs	5 TTL inputs (freely definable)	
Switching outputs	12 TTL outputs (freely definable)	
	2 relay outputs	
Other connections	Foot switch for two functions, remote keypad	
Accessories	Foot switch, remote keypad, protective cover, tilting base, mounting adapter	
Power connection	100 to 240 V AC (–15 % to +10 %), 47 Hz to 63 Hz; ≤ 100 W	
Operating temperature	0 °C to 45 °C (storage temperature –20 °C to 70 °C)	
Protection EN 60529	IP 40	
Mounting*	Tilting base or mounting base	
Weight	*ND with tilting base:* ≈ 4.8 kg; *ND with mounting adapter:* ≈ 2 kg	

***** Please select when ordering
1) Depends on the signal period of the connected encoder as well as the subdivision factor

MSE 1000
– The modular evaluation unit for multipoint inspection apparatuses

The MSE 1000 modular evaluation unit with its modular design has been specially conceived for multipoint inspection apparatuses and shop-floor metrology. At the same time, such measuring apparatuses—which can be designed as stations for statistical process control (SPC)—also serve for statistical evaluation of the measured values and thus permit a qualified process control. They can be equipped with a large number of differing measuring devices.

The MSE is especially attractive for these areas of application for the following reasons:

- Flexibility for adaptation to differing conditions of operations
- A variety of interfaces for connection of numerous measuring devices
- Fast communication with higher-level computer systems over Ethernet
- Outputs for controlling sorting switches, warning lamps, PLC, etc.
- Output of measurement results for documentation and further processing

Design

The MSE 1000 consists of individual modules with various interfaces. They permit connection of incremental, absolute and analog measurands, the output of switch signals, and communication over diverse interfaces. The basic configuration of the MSE 1000 consists of a power module and a basic module. It can be expanded by further modules as needed. Users can configure up to 250 axes or channels to meet their specific needs.

Functions

The functions of the MSE 1000 are defined by the PC software used.

MSEsetup

This software package is available for download at www.heidenhain.de. It handles the basic functions of the MSE 1000:

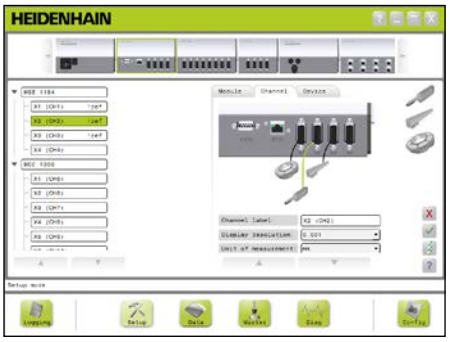
- Configuration (modules, encoder inputs, data transmission)
- Diagnostics
- Data transfer to the PC
- Writing the measured values to an Excel table

MSElibrary

This program library (DLL) for Windows operating systems is required if the MSE 1000 is to be operated with a customer-specific software application. The Ethernet driver provides functions that permit communication between the MSE 1000 and a PC.

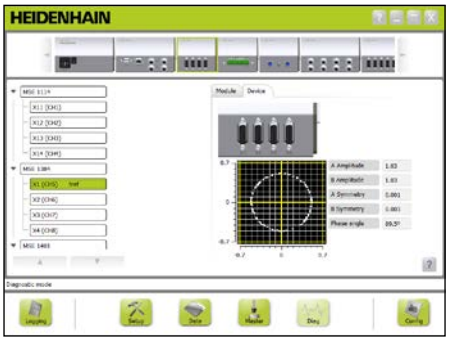
The interfaces in C/C++ make application development possible using Visual Studio C/C++, Visual Basic and Delphi. Also available as a LabView virtual instrument (VI).

MSElibrary is also available for download at *www.heidenhain.de*.

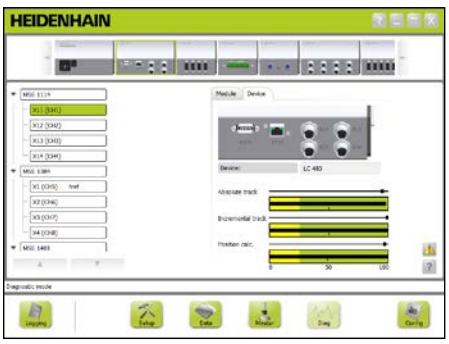


Configuration of the channels

Data acquisition



Diagnostics of 1 V_{PP} signals



Functional reserve with EnDat devices

	MSE 1000
Measuring channels/axes	Up to 250
Data transfer rate	20 to 100 measured values per second for all axes; depends on the configuration
Data transfer	Standard Ethernet, IEEE 802.3
Addressing	Fixed IP address or DHCP
External latch inputs	2 (e.g. for foot switch)
Software	**MSEsetup:** Graphic-supported configuration of the system, diagnosis of the encoders, loading of data to Excel
	MSElibrary: Library (DLL) for integration in the customer's software under Windows
Voltage supply*	100 V to 240 V AC (±10 %), 50 Hz to 60 Hz (±2 %), ≤ 108 W 24 V DC (±10 %), ≤ 72 W
Operating temperature	0 °C to 45 °C (storage temperature –20 °C to 70 °C)
Degree of protection*	IP 40, optionally IP 65
Assembly	Top hat rail, on mounting bracket or in electrical cabinet (specially conceived for 19-inch cabinet)
Accessories	Mounting bracket, foot switch, connecting cable

***** Please select power supply unit when ordering

MSE 1000
– Modules

Modules		Description	Interface	Connections	Protection	Width a	Power consumption[1]	Type
Required	**Basic**	Basic unit with complete functionality • Ethernet 10/100 for connection to the PC • Encoder inputs • 2 latch inputs ⊓⊔TTL	4 encoders EnDat 2.2	M12, 8-pin, female	IP 65	159 mm	3.5 W	MSE 1114
			4 encoders ∿ 1 V_{PP}	D-sub, 15-pin, female	IP 65		3.8 W	MSE 1184
			4 encoders ⊓⊔TTL	D-sub, 9-pin, female	IP 65		2.7 W	MSE 1124
	Power supply	Supply unit Output power 50 W	100 V AC to 240 V AC	Power plug	IP 40	159 mm	–	MSE 1201
				PG cable gland[3]	IP 65			
		Supply unit Output power 70 W	24 V DC	M8, 3-pin, female	IP 65			MSE 1202
Optional	**EnDat**	Bidirectional encoder interface (purely serial)	4 encoders EnDat 2.2	M12, 8-pin, female	IP 65	106 mm	3.3 W	MSE 1314
			8 encoders EnDat 2.2		IP 65	159 mm	4.4 W	MSE 1318
	Sinusoidal	Counter module for incremental encoders	4 encoders ∿ 1 V_{PP}	D-sub, 15-pin, female	IP 65	106 mm	3.5 W	MSE 1384
			8 encoders ∿ 1 V_{PP}		IP 65	159 mm	5.0 W	MSE 1388
	Square wave	Counter module for incremental encoders	4 encoders ⊓⊔TTL	D-sub, 9-pin, female	IP 65	106 mm	2.4 W	MSE 1324
			8 encoders ⊓⊔TTL		IP 65	159 mm	2.5 W	MSE 1328
	Analog	Axis module for analog inputs	2 inputs ±10 V or 4 to 20 mA	D-sub, 9-pin, female	IP 65	106 mm	3.2 W	MSE 1332
	HBT	Axis module for the connection of inductive position encoders	8 inputs, half-bridge, Tesa and Solartron compatible	Lumberg, 5-pin, female	IP 65	159 mm	4.6 W	MSE 1358
	LVDT		8 inputs, full bridge, Mahr or Marposs compatible					
	I/O	Floating inputs/outputs	4 relay outputs 4 TTL switching inputs	Terminal block	IP 40	106 mm	6.1 W[2]	MSE 1401
				M8, 3-pin, female[4]	IP 65			
	Compressed air	Air switch for activation of pneumatic length gauges	1 input 1 output Compressed air	Plug-in connections for 4 mm tube	IP 65	106 mm	3.7 W[2]	MSE 1501

Modules providing connection to further encoders and interfaces are planned.
[1] Power consumption of the module. Connected encoders must be considered additionally; see the example calculation
[2] With outputs under load
[3] Three-meter power cable with PG gland included in delivery
[4] Three mating connectors included in delivery

Example calculation of power consumption

The power supply module (MSE 1201, MSE 1202) provides the electrical power for further modules and encoders. If the power provided does not suffice to operate the desired system configuration, a further power supply module must be used.

The power consumption is specified for each module (see table). The power consumption of the connected HEIDENHAIN encoders can be calculated from the catalog data (supply voltage x current consumption). For all other consumers (e.g. inductive and analog sensors), the connected load must be known. The sum power of all consumers must not exceed the rated power of the power supply module(s).

The following example illustrates this calculation.

Components to be supplied

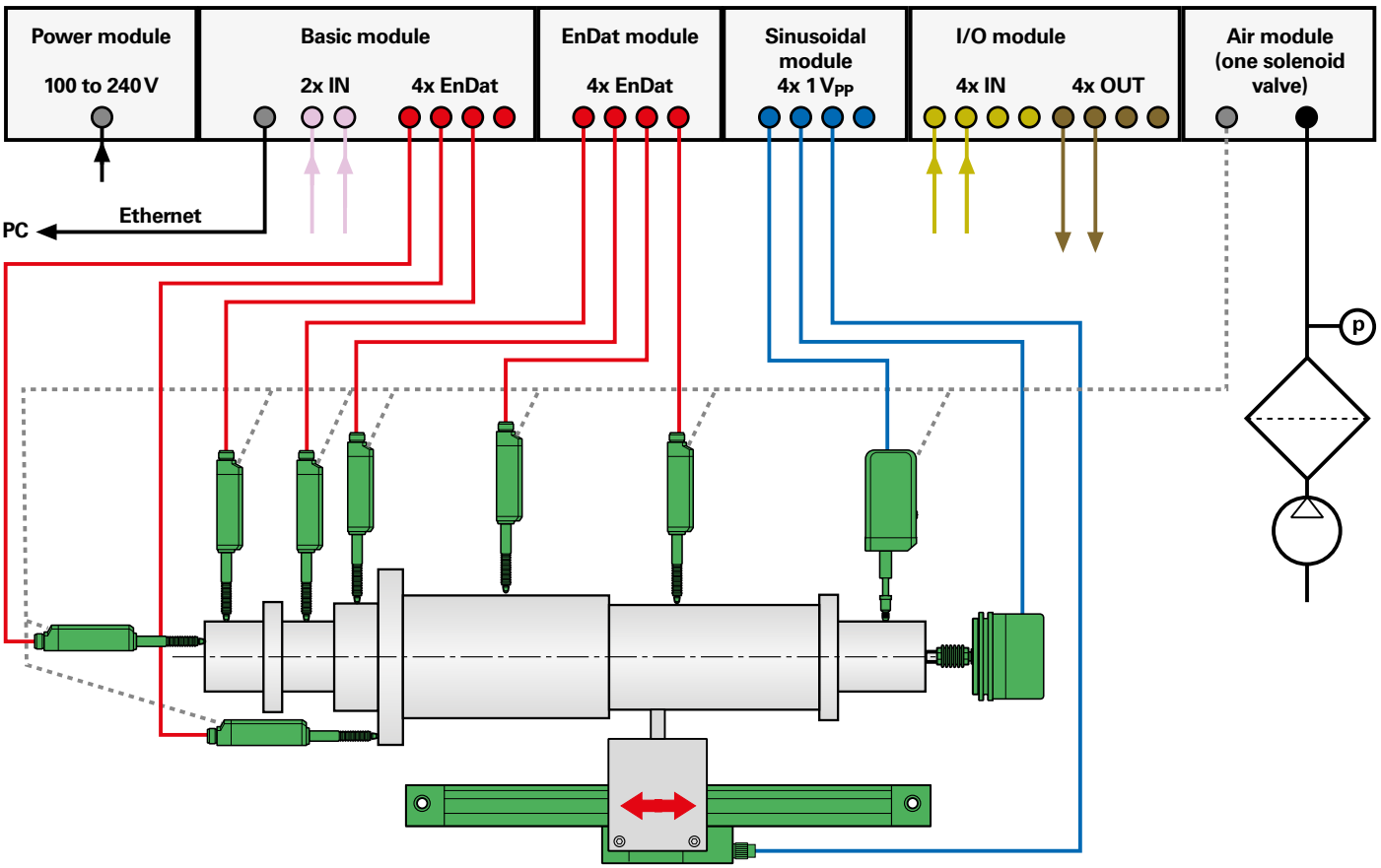
Encoders: 8 x ACANTO AT 1217, 12 x SPECTO ST 1288, 2 x LS 388C, 2 x temperature sensors 20 V/100 mA

Modules: 1 x basic module MSE 1114, 1 x axis module MSE 1314, 2 x axis module MSE 1388, 1 x compressed air module MSE 1501, 1 x analog module MSE 1332

Power calculation

	Data from catalog and calculated				Total power consumption (example)
	Operating voltage	**Current consumption**	**Power consumption/ unit**	**No. of units**	
ACANTO AT 1217	5 V	150 mA	0.75 W	8	6 W
SPECTO ST 1288	5 V	90 mA	0.45 W	12	5.4 W
LS 388C	5 V	100 mA	0.5 W	2	1 W
Thermistor	20 V	100 mA	2 W	2	4 W
MSE 1114	–	–	3.5 W	1	3.5 W
MSE 1314	–	–	3.3 W	1	3.3 W
MSE 1388	–	–	5 W	2	10 W
MSE 1501	–	–	3.7 W	1	3.7 W
MSE 1332	–	–	3.2 W	1	3.2 W
Total:					40.1 W

This power consumption can be met by **one** MSE 1201 (50 W) or MSE 1202 (70 W) power supply module.



EIB 700
– The evaluation unit with measured-value memory

The EIB 700 evaluation electronics feature connections for four axes. They are ideal for precise position measurement in particular for inspection stations and multipoint inspection apparatuses as well as for mobile data acquisition, such as in machine calibration.

The EIB 700 series are ideal for applications requiring high-resolution encoder signals and fast measured-value acquisition. Ethernet transmission also enables you to use switches or hubs for connecting more than one EIB. It is also possible to use WLAN transmission, for example.

Execution
The EIB 700 features a bench-top housing. With an accessory mounting bracket it can also be easily built into a 19-inch housing. They are designed for the following voltage supplies:
EIB 741: 100 V AC to 240 V AC
EIB 742: 24 V DC

Functions
The EIB 700 subdivides the periods of the incremental signals up to 4096-fold for **measured-value generation.** The deviations within one signal period are automatically reduced by adjustment of the sinusoidal incremental signals.

The integrated **measured-value memory** enables the EIB 700 series to save typically 250 000 measured values per axis. Internal or external triggers can be used for axis-specific storage of the measured values.

The **interval counter** permits position-dependent triggering in connection with an incremental encoder on axis 1. In addition, the signals of axis 1 are interpolated and forwarded to a position counter. Triggering pulses are generated either at a certain position or equidistantly in adjustable intervals. They begin after an adjustable start position has been traversed and continue in both counting directions. The trigger pulses can be used for triggering further EIB internal axes or also over a trigger output.

Data interface
A standard Ethernet interface using TCP/IP or UDP communication is available for **data output.** This permits direct connection to a PC, laptop or industrial PC. The type of measured-value transfer can be selected through the operating mode (transfer of individual values, block transfer, or transfer upon software request).

Driver software for Windows, Linux and LabVIEW as well as example programs and the EIB application software are included in the items supplied, in order to **process the measured values** on the PC. The driver software enables customers to easily program their own applications. In addition, example programs demonstrate the capabilities of the EIB 700 series. The EIB application software serves for commissioning and demonstrating the capabilities of the EIB 700 series. This software is made available in the source code and can serve as a platform for the development of one's own applications.

The **range of features** can be enhanced by updating the firmware.

Operating modes	Soft Realtime Mode	Recording	Streaming	Polling
Properties	Immediate transmission of measured values when the trigger event occurs	Storage of measured values in the EIB's internal measured-value memory	Buffering and block transfer of measured values	Software request from customer application
Selectable trigger sources	All internal and external sources			By software command
Trigger rate	≤ 10 kHz (access time to position values < 100 µs)	≤ 50 kHz	≤ 50 kHz Max. 1 200 000 bytes/s	Depends on the application
Typical applications	Closed loop control	Very high recording rate Offline analysis of data	High recording rate in combination with high recording depth	Quasi-static measured value recording

	EIB 741, EIB 742		
Encoder inputs	D-sub connections, 15-pin, female (X11 to X14), for four encoders		
Input signals (switchable)	∿ 1 V_{PP} (∿ 11 μA_{PP} upon request)	EnDat 2.1	EnDat 2.2
Voltage supply for encoders	5.12 V DC ±0.15 V; max. 450 mA per channel Overcurrent protection (automatic switch-off, resettable) at 550 mA		
Input frequency	≤ 500 kHz	–	–
Subdivision factor	4096-fold	–	–
Signal adjustment	Automatic adjustment of offset, phase and amplitude	–	–
Cable length[1]	≤ 150 m	≤ 150 m	≤ 100 m
Data register for measured values	48 bits (only 44 bits are used)		
Interval counter	• Derived from axis 1 (only 1 V_{PP}), • Interpolation factor can be set from 1-fold to 100-fold • Can be used as trigger source or additional counting axis		
Measured-value memory	Typically 250,000 position values per channel		
Measured-value trigger[2]	Storage of the measured values of the four axes alternatively through external or internal trigger. ***External:*** • Signal via trigger input • Software command (over Ethernet) ***Internal:*** • Timer • Interval counter • Reference pulse of the respective axis (from axis 1 also possible for other axes)		
Trigger input[3]	D-sub connections, 9-pin, male; differential inputs as per RS-485 (terminating resistors can be activated)		
Trigger output[3]	D-sub connection, 9-pin, female, 4 differential inputs as per RS-485		
Access to measured values	Depends on the selected operating mode (see separate table)		
Software	• Driver software for Windows, Linux and LabVIEW • Program examples • EIB application software		
Data interface	Ethernet as per IEEE 802.3 (max. 1 GB) (data cable must be suitable)		
Network address	Automatic assignment through Dynamic Host Configuration Protocol (DHCP) or manual assignment		
Operating temperature	0 °C to 45 °C (storage temperature –20 °C to 70 °C)		
Voltage supply	**EIB 741:** 100 V to 240 V AC (±10 %), 50 Hz to 60 Hz (±2 Hz), power consumption approx. 30 W **EIB 742:** DC 24 V (–15 %/+20 %), ≤ 2 A		

[1] The supply voltage range of the encoder must be maintained; specified cable length applies when HEIDENHAIN cables are used.
[2] Different trigger sources can be assigned to the individual axes.
[3] Can also be used as logical input or output.

IK 220
– The evaluation electronics as PC solution

The IK 220 evaluation unit is a PC counter card for two axes. It is inserted directly into a free PCI slot in the computer. The IK 220 is ideal for applications in which the measured-values are to be evaluated directly in the PC.

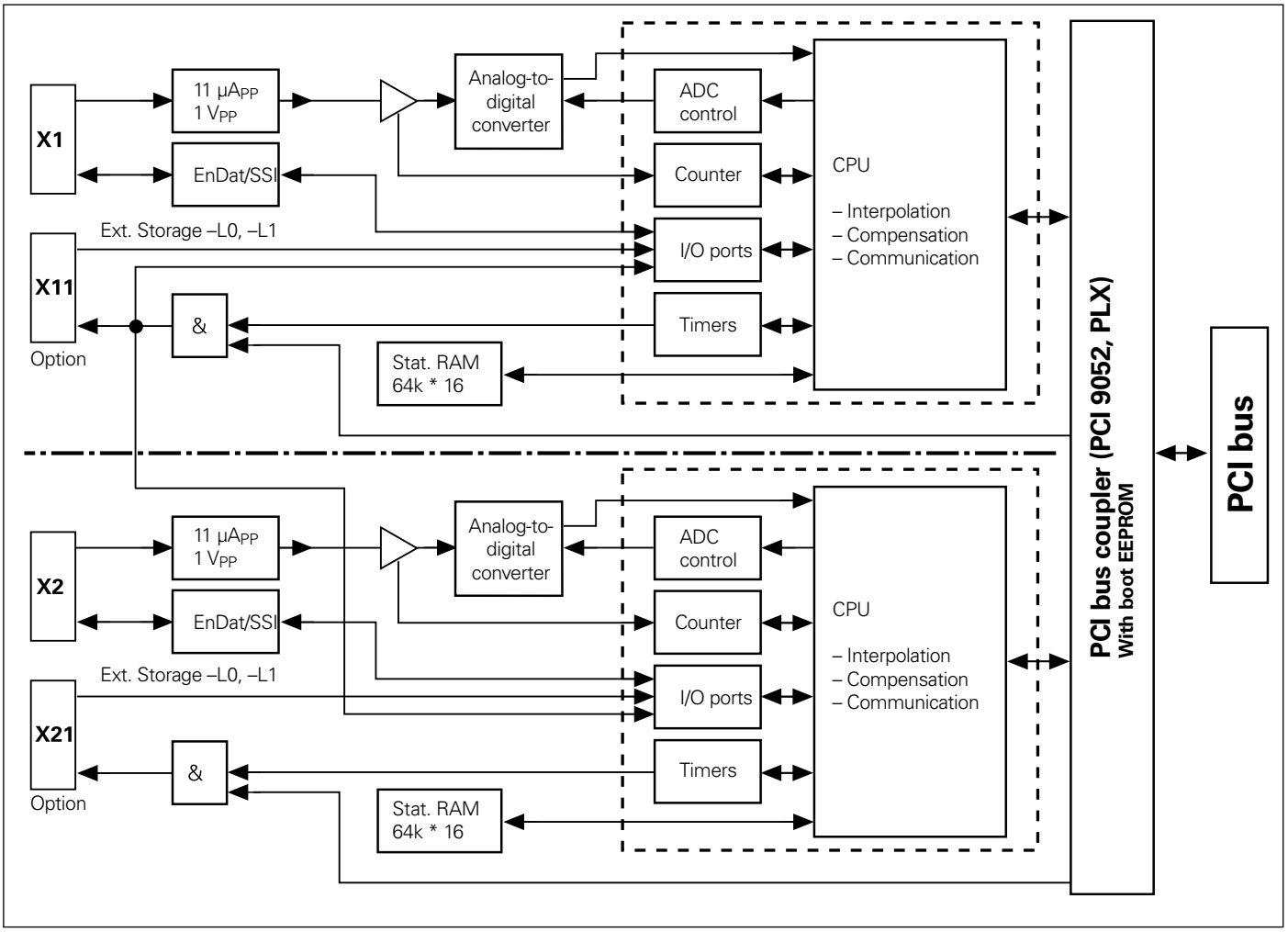
Design
Two HEIDENHAIN encoders with sinusoidal current signal (⌒ 11 μA_{PP}), sinusoidal voltage signal (⌒ 1 V_{PP}), EnDat 2.1 or SSI interface can be connected to the IK 220. External latch inputs/outputs and the output of (⌒ 11 μA_{PP}) measured value signals can be realized by using additional slot covers (accessory).

Functions
The IK 220 subdivides the periods of sinusoidal encoder signals up to 4096-fold for measured-value generation. They are called and stored either by using external latch inputs or by software.

The IK 220 features an integrated **measured value memory.** A total of up to 8192 measured values can be stored in the buffer and downloaded in a single block.

The **measured values are further processed** in the PC by programs created by the operator. To demonstrate the PC counter card's capabilities, examples of such programs and driver software for 2000/XP/Vista/7 (32/64-bit) are supplied with the card.

Basic circuit diagram



	IK 220			
Encoder inputs	Two D-sub connections (15-pin), male (X1 and X2); for two encoders			
Input signals (switchable)	⁓ 1 V_{PP}	⁓ 11 μA_{PP}	EnDat 2.1	SSI
Input frequency	≤ 500 kHz	≤ 33 kHz	–	
Cable length[1)]	≤ 60 m		≤ 10 m	
Adjustment of encoder signals	Offset, phase and amplitude are adjusted through software			
Signal subdivision	4096-fold			
Data register for measured values	48 bits; only 44 bits are used for the measured value			
Internal memory	For 8192 position values			
Measured-value trigger	Alternatively through • External latch signals (over separate IK assembly for external inputs/outputs) • Software command • Timer • Traversing the reference marks			
Access time to measured values	• *Without adjustment, without compensation run:* **≤ 100 µs** • *With adjustment, without compensation run:* **≤ 110 µs** • *With adjustment, with compensation run:* **≤ 160 µs**		Depends on encoder	
Interface	PCI bus (plug and play) Local Bus Specification Rev. 2.1			
Driver software and demonstration program	For Windows 2000/XP/Vista/7 (32-bit and 64-bit) in VISUAL C++, VISUAL BASIC and BORLAND DELPHI			
Encoder outputs	⁓ 11 μA_{PP} Over PCB connector in the IK (10-pin, female) Fitting cable assembly with PC-slot cover available as option			
Power consumption	≈ 4 W, without encoders			
Dimensions	190 mm x 100 mm			
Operating temperature	0 °C to 55 °C (storage temperature –30 °C to 70 °C)			

[1)] With HEIDENHAIN cable; greater cable lengths upon request

Mounting
Mounting of ND 100

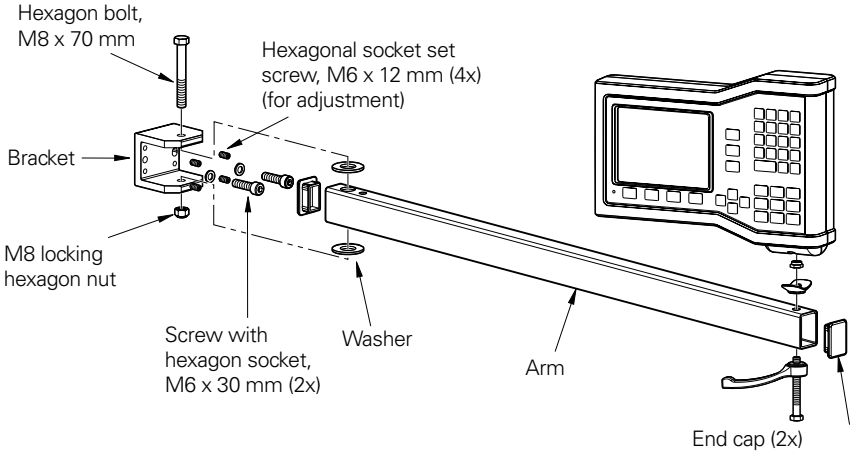
You can set up the ND 12x either on a mounting arm on the machine, with the aid of a mounting adapter, or install it in a control panel. The parts required for fastening the display are included in delivery. They enable you to rotate and tilt the display. The mounting arm, mounting base, and mounting frame are available as accessories:

ND 123

Accessories

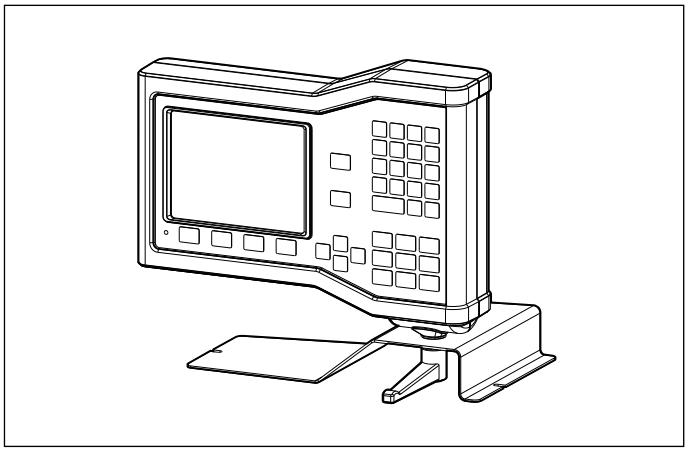
Mounting arm, straight
ID 382893-01

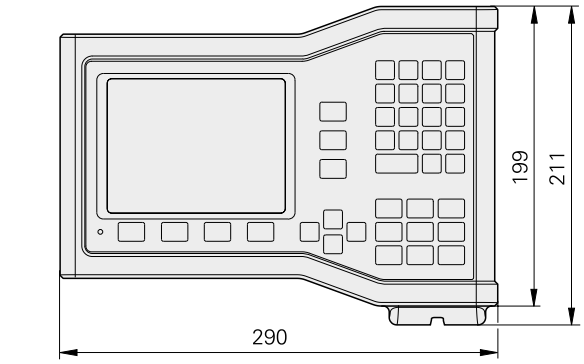
You can use the mounting arm to easily place the display at a conveniently operable position. It can be attached to the machine and swiveled by either a bracket or a hex bolt. The display is attached to the mounting arm via its own tilt/swivel mount.

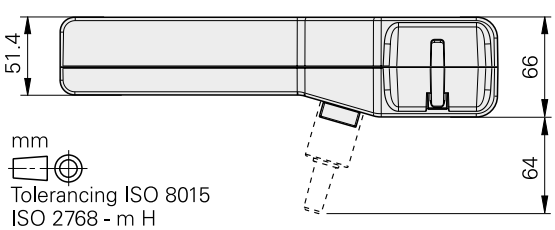

Hexagon bolt, M8 x 70 mm
Hexagonal socket set screw, M6 x 12 mm (4x) (for adjustment)
Bracket
M8 locking hexagon nut
Screw with hexagon socket, M6 x 30 mm (2x)
Washer
Arm
End cap (2x)

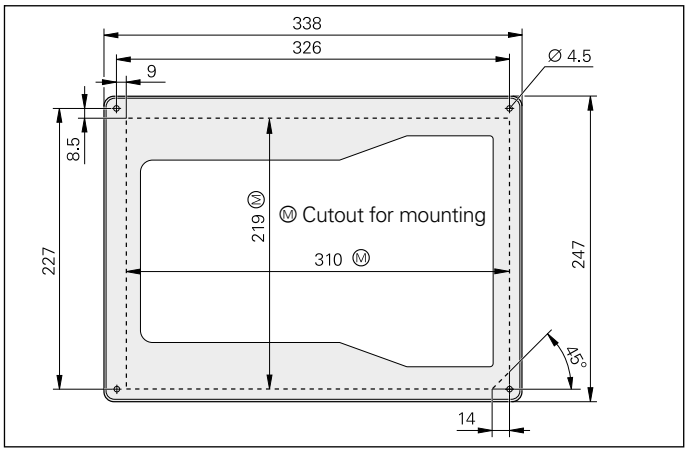
Mounting stand
ID 625491-01

Mounting frame
ID 647702-01
For mounting the ND 12x in a housing or operating panel.









Mounting of ND 200

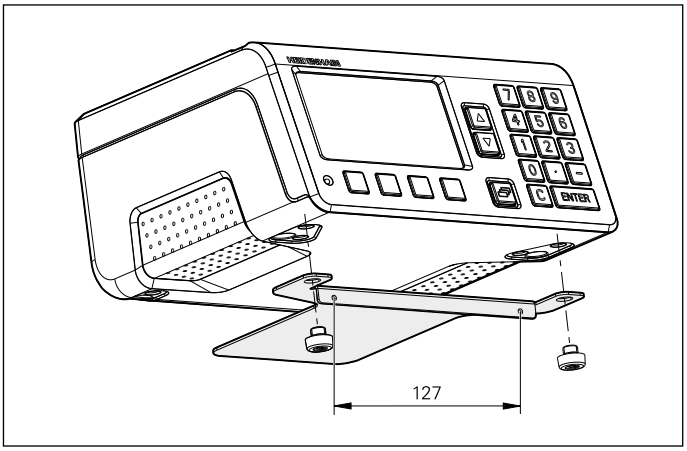
ND 200 series
The ND 200 series digital readouts were conceived as bench-top units. They can easily be stacked. Recesses on the top prevent the stacked units from moving out of place.

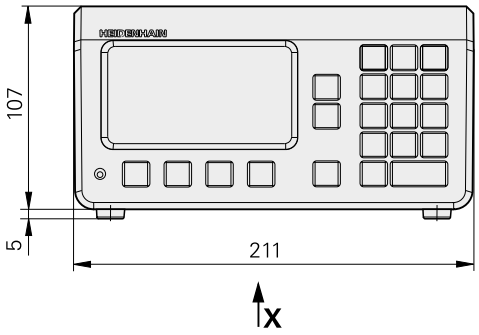
You can secure the ND 28x from below by using M4 screws on a base plate.

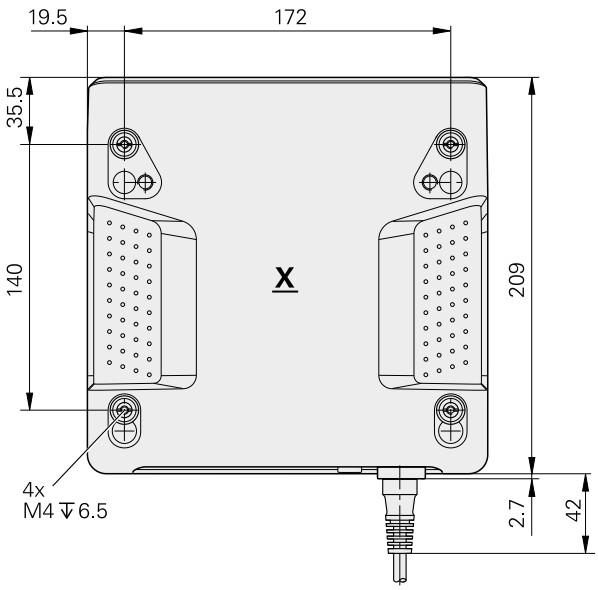
Two ND 28x readouts fit next to each other in a 19″ housing. A mounting adapter is available as an accessory for mounting in a 19″ housing.

Accessories
Mounting adapter for 19″ housing
ID 654020-01

ND 287







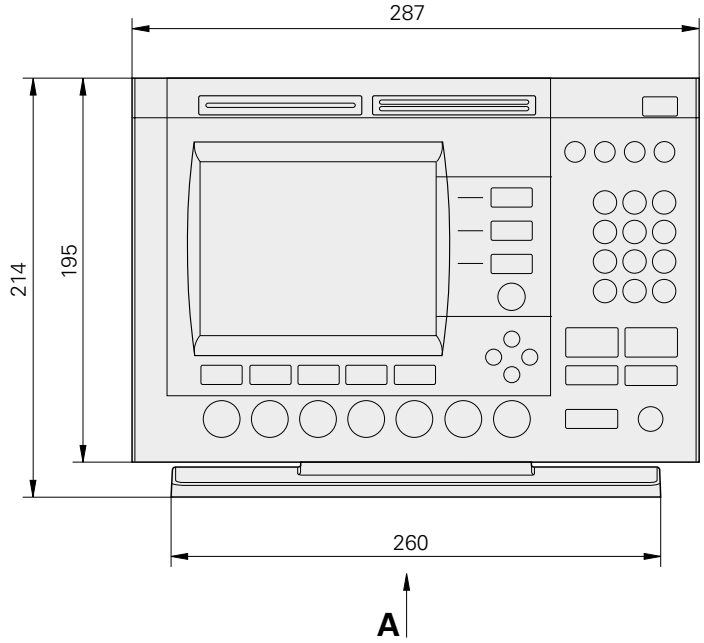
Mounting the ND 1000/ND 2000

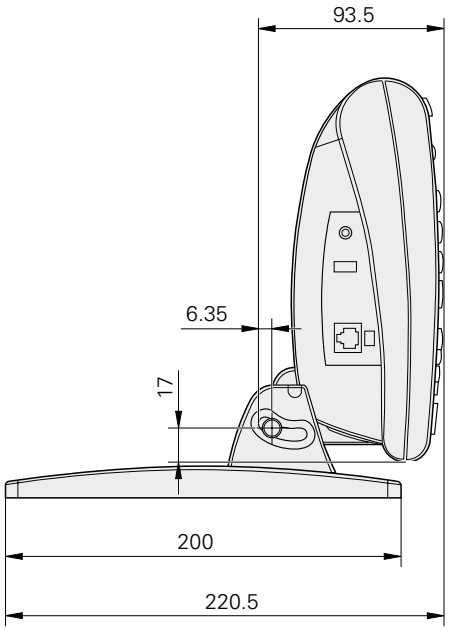
The ND 1000 and ND 2000 are shipped with either a tilting base or a mounting base.

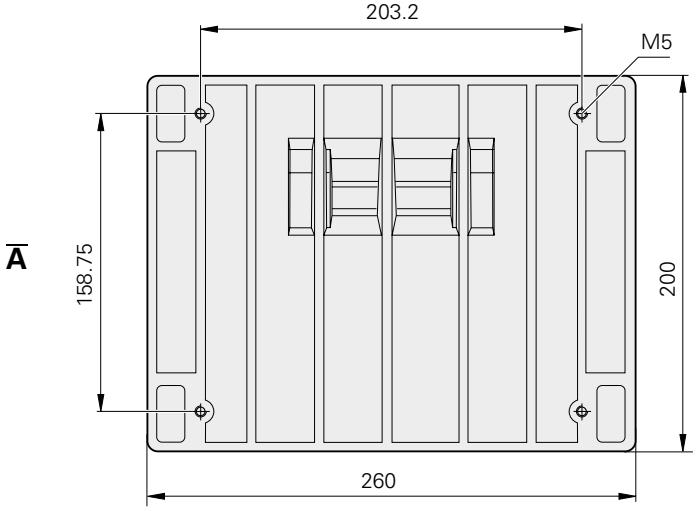
Mounting stand
The readout can be used as a tabletop unit when placed on the tilting base. The readout can then be tilted forward or backward by up to 20° for the best reading angle. The tilting base can be attached with M5 screws.

ID 382892-02

ND 1300 with tilting base



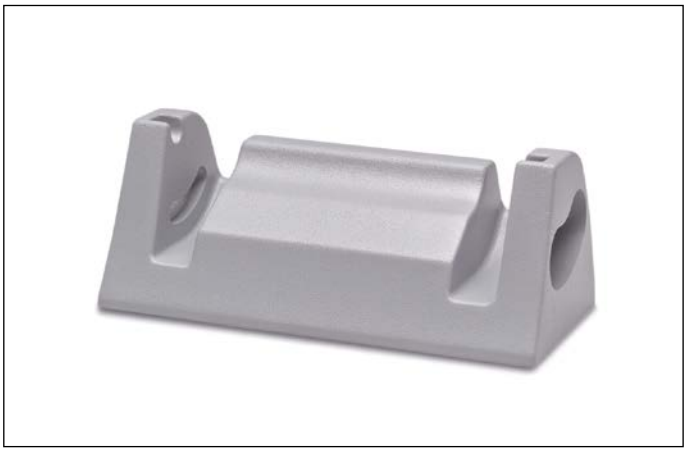




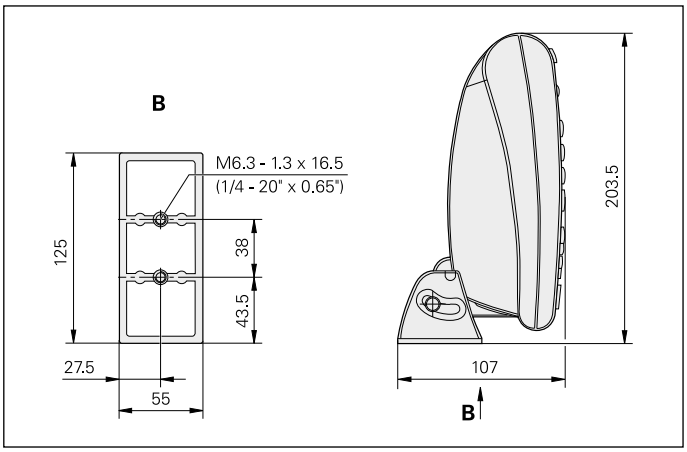
mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm

Mounting adapter
The mounting base is used to attach the ND 1000 or ND 2000 to a mounting arm or directly to the machine. It also enables the user to tilt the readout.

ID 682419-01



Mounting adapter

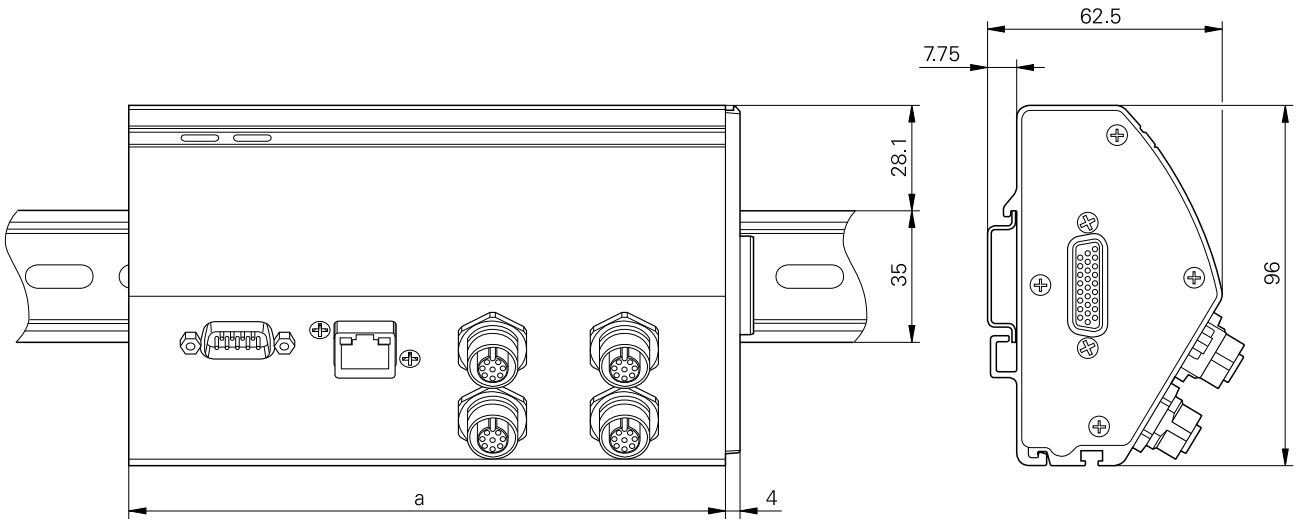


Accessories
Protective cover
Protective covers are available as accessories for protecting the keyboard and screen of the ND 1000/ND 2000 from becoming soiled. The display can still be easily read through the transparent protective covers. They fit themselves optimally to the front of the unit, without impairing the ease of operation.

ND 11xx (1/2 axes)	ID 681051-02
ND 11xx (3/4 axes)	ID 681051-03
ND 21xx	
ND 12xx	ID 681051-01

Mounting the MSE 1000

The MSE 1000 modules are easily mounted on a standard rail in a cabinet or on a mounting base (accessory). The individual modules are plugged onto each other and fixed together with a lock. This also connects the internal bus and the power supply. The module widths are selected so that the MSE 1000 is also suitable for a 19" housing.



mm

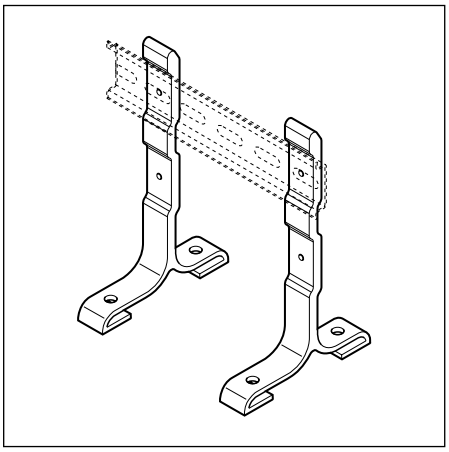
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm

	a
Size 1	53 mm
Size 2	106 mm
Size 3	159 mm

Accessories

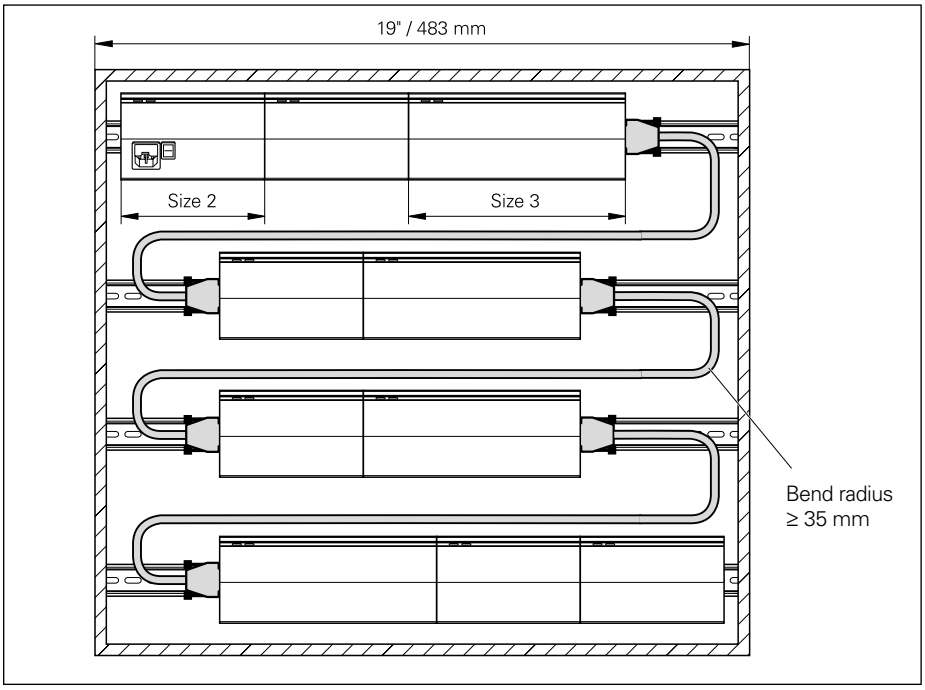
Mounting stand

For mounting the MSE on a (table) surface. Two mounting brackets are connected together by two standard top hat rails. Two rows of modules or one MSE can be connected to it and a cable channel can be fastened.
ID 850752-01



Connecting cables

For connecting two or more MSE rows, e.g. during mounting in the electrical cabinet.
ID 850753-xx

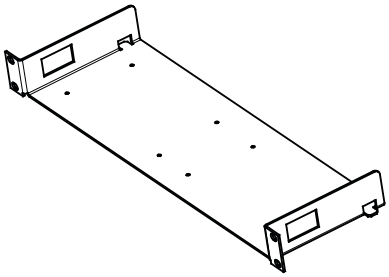


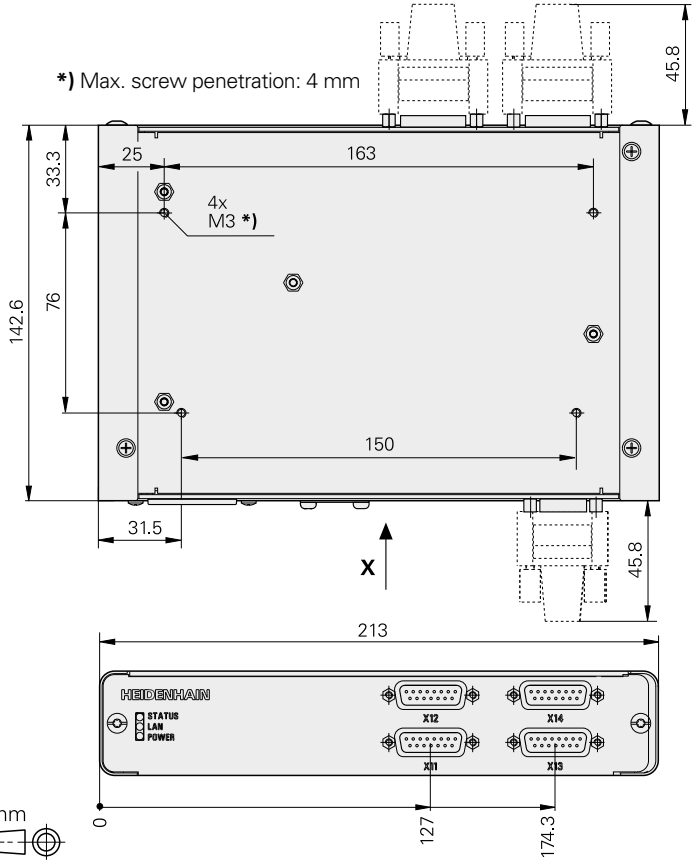
Mounting the EIB 700

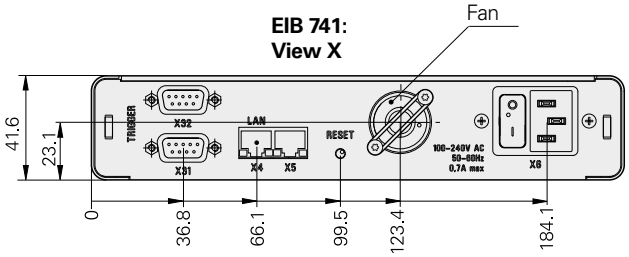
The EIB 700s were conceived as bench-top units. They must be installed in a well ventilated area. The operating orientation is specified.

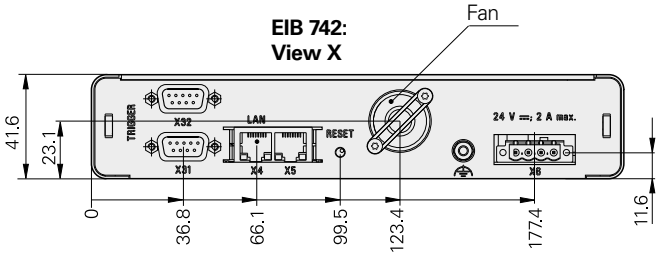
You can secure the EIB 700 from below by using M4 screws on a base plate. Two EIB 700s fit next to each other in a 19" housing. They occupy one height unit. A mounting bracket is available as an accessory.

Accessories
Mounting bracket
For installation of two EIB 74x in a 19-inch housing
ID 671144-01









mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm

Accessories
Calibration and demonstration parts

HEIDENHAIN offers various calibration parts as accessories in order to calibrate the optical and tactile edge detection methods.

Calibration standard
For the calibration of video measuring machines, measuring microscopes and profile projectors. It can be traced back to national or international standards.

ID 681047-01

2-D demo part
The 2-D demo part is included with the ND 1200, ND 1300 and IK 5000. The application examples in the User's Manuals are based on this part. It can be reordered if a replacement is necessary.

ID 681047-02

3-D demo part (accessory)
Demo part for touch-probe applications. Examples in the ND 1400 and IK 5000 User's Manuals are based on this part.

ID 681048-01

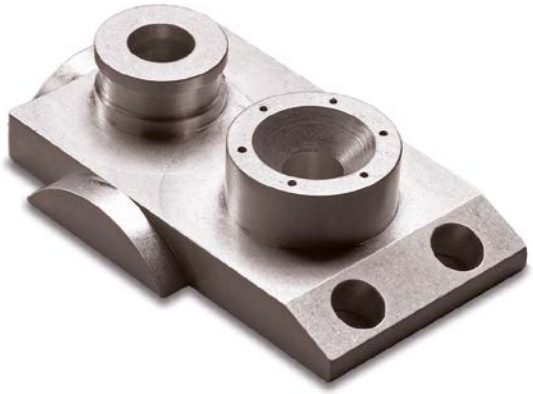
3-D demo part for multi-sensor scanning (accessory)
Demo part specifically for applications that combine touch-probe systems and video edge detection. It is used for the examples in the IK 5000 User's Manual.

ID 681048-02

Calibration standard

2-D demo part

3-D demo part


3-D demo part for multi-sensor scanning

External control elements

The evaluation electronics and the PC package can be operated easily and intuitively. However, remote operability may also be useful and convenient in some situations. The following components are available for remote operation:

Foot switch (accessory)
Cable length 2.4 m

For ND with RJ45 connector
with two freely assignable keys
ID 681041-01

For IK 5000 with 4-pin DIN connector
with two freely assignable keys
ID 681041-02

For MSE 1000 with 9-pin D-sub connector
with two keys ID 681041-03

Remote keypad (accessory)
For remote operation of the evaluation unit; features a numeric keypad and "enter" and "finish" keys; cable length: 4.5 m; with RJ45 connector.

ID 681043-01

Joystick (accessory)
For remote operation and sensitive traversing of axes for ND 1300 and IK 5000. With 15-pin D-sub connector.

Without trackball	ID 681044-02
With trackball	ID 681044-01
With trackball and Z-focus fine adjustment	ID 681044-05

Foot switch

Remote keypad

Joystick without trackball

Joystick with trackball and Z-focus fine adjustment

Optical edge sensor and amplifier

Optical edge detector

Two fiber-optic cables are necessary for edge detection with the optical edge finder. One fiber-optic cable is attached to the projection screen with a transparent holder. The second cable is attached near the transmitted light source so that the fibers point toward the light source. The following accessory components are required.

Fiber-optic cable (accessory)
With one right-angle end and an SMA connector (subminiature A) for ND or IK.
Bend radius ≥ 25 mm
Temperature ≤ 100 °C
Lengths 2 m, 3 m, 5 m

ID 681049-xx

Fiber-optic cable

Holder (accessory)
With a hole for accepting the right-angle end of fiber-optic cables. Transparent design so that it can be attached to the projection screen.
Lengths: 350 mm, 600 mm, 760 mm

ID 681050-xx

Holder

Fiber-optic cable connector (accessory)
Two SMA connectors (subminiature A) for connecting an integrated edge finder.
Bend radius ≥ 25 mm
Temperature ≤ 100 °C
Lengths 2 m, 3 m, 5 m

ID 681049-xx

Fiber-optic cable connection

Amplifier for CNC

For the versions with CNC axis positioning, HEIDENHAIN supplies the appropriate amplifiers for stepper motors. The connecting cables are available upon request.

Amplifier for CNC stepper motor
(accessory)
For two-phase stepper motors
Rated voltage: 48 V DC

For 2 axes:
Current per axis ≤ 2.5 A
Power per axis ≤ 120 W
240 V AC line voltage ID 681045-01
120 V AC line voltage ID 681045-03

For 3 axes:
Current per axis ≤ 1.67 A
Power per axis ≤ 80 W
240 V AC line voltage ID 681045-02
120 V AC line voltage ID 681045-04

Amplifier for CNC stepper motor

Interfaces

Evaluation electronics with integrated display

The evaluation electronics feature interfaces for encoders, for communication and for external components.

	ND 122 ND 123	ND 1102 ND 1103 ND 1104	ND 1202 ND 1203 ND 1204	ND 1302 ND 1303 ND 1304		ND 1404	ND 1202T	ND 2104G ND 2108G	ND 287
Encoders									
1 V_{PP}/11 μA_{PP}	–/–	●/–	●/–	●/–	●/–	●/–	●/–	●/–	●/●
TTL	●	●	●	●	●	●	●	●	–
EnDat 2.2.[1]	–	–	–	–	–	–	–	●	●
Touch probes	–	●[2]	–		–	●[2]	–	–	–
Video	–	–	–	●[3]	–	–	–	–	–
Fiber-optic cable	–	–	Option[4]	–	●	–	–	–	–
Sensor ±10 V	–	–	–	–	–	–	–	–	Option
Data									
USB	Type B	Type A	Type A	Type A	Type A	Type A	Type A	Type A	Type B
RS-232-C/V.24	–	●	●	●	●	●	●	●	●
Ethernet	–	–	–	–	–	–	–	–	Option
Light control	–	–	–	Option	–	–	–	–	–
Zoom	–	–	–	Option	–	–	–	–	–
CNC outputs	–	–	–	Option	Option	–	–	–	–
Foot switch	–	●	●	●	●	●	●	●	–
Remote keypad	–	●	●	–	–	–	●	●	–
Switching outputs	–	–	–	–	–	–	–	12 TTL	6 TTL
Switching inputs	–	–	–	–	–	–	–	5 TTL	12 TTL

● = Available
– = Not available
1) Purely serial, no evaluation of the incremental signals
2) HEIDENHAIN or Renishaw touch probe
3) S-Video and composite
4) With ND 1204 on request

Optional assemblies with ND 287

Various input and output assemblies are available for the evaluation electronics

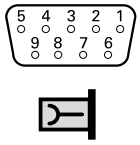
Second encoder input (option)
The ND 287 evaluation unit can be equipped with an optional second encoder input.

Encoder module
Input assembly for second encoder with 1 V_{PP}, 11 μA_{PP} or EnDat 2.2. interface
ID 654017-01

Analog input (option)
The ND 287 digital readout can be equipped through an optional input assembly with an additional analog input connecting a sensor. The input voltage range is interpolated 4096-fold; for a sensor with ±10 V the resolution is therefore 5 mV. The analog module provides 5 V DC, 12 V DC and 24 V DC as power supply for the sensor.

The 5 V DC (B) and 12/24 V DC (A) are galvanically isolated. They must not be used at the same time. A 9-pin D-sub connector is required as mating connector.

Analog module
Input assembly for ±10 V analog sensor
ID 654018-01

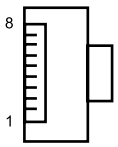


Pin	Assignment
1	–12 V (A)/85 mA
2	0 V (A)
3	0 V (A)
4	+12 V (A)/85 mA
5	Shield
6	0 V (B)
7	0 V (B)
8	Sensor (B) ±10 V max.
9	+5 V (B)/400 mA

Ethernet (option)
The ND 287 evaluation unit can be equipped with an optional Ethernet module.

Ethernet module
ID 654019-01

The module is provided with an Ethernet 100BaseT interface with RJ45 connector (female, 8-pin). This enables you to connect the ND 287 directly to your company's intranet or, with a crossover cable, to a PC.



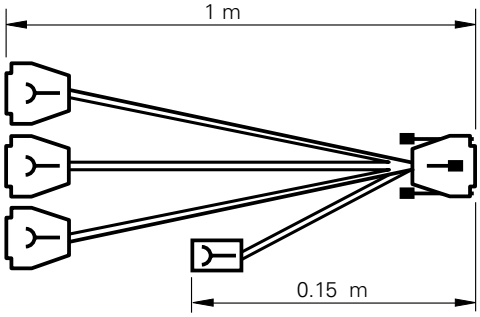
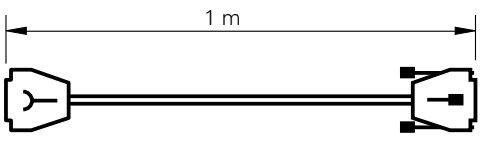
Pin	Assignment
1	TX+
2	TX–
3	REC+
4	Do not assign
5	Do not assign
6	REC–
7	Do not assign
8	Do not assign
Housing	External shield

IK 5000 evaluation unit

Connections to the IK 5000 are made via its D-sub connectors. Depending on the version, further connections are made through one, two or three additional slot covers. Please order the adapter cables necessary between the individual components separately.

		IK 5293	**IK 5294**	**IK 5394**		**IK 5493**	**IK 5494**		**IK 5594**
	Slots[1]	*2*	*2*	*3*	*4*	*3*	*4*	*4*	*4*
	Position								
Encoders for X, Y, Z	*IK*	1 V_{PP} or TTL							
CNC outputs	*IK*	–	–	–	–	●	●	●	●
Foot switch	*IK*	●	●	●	●	●	●	●	●
Fiber-optic cable	*Slot L*	–	–	●[2]	–	●[2]	–	–	–
Touch probe[3]	*Slot 1*	●	–	–	●	–	–	●	TP 200
Light control	*Slot 1*	–	–	–	●	–	●	●	●
Encoder for Q	*Slot 2*	–	1 V_{PP} or TTL						
Zoom	*Slot 3*	–	–	–	●	–	●	●	●
Video	*PC*	–	–	–	USB camera[4]	–	USB camera[4]	USB camera[4]	USB camera[4]

● = Standard; – = Not available
[1] Including IK; [2] Connected directly to the IK PCB, special slot cover with cable guide included in delivery
[3] HEIDENHAIN or Renishaw touch probe; [4] Connected to the USB port of the PC

Adapter cable		**1 V_{PP}**	**TTL**
Complete with D-sub connector (female), 15-pin (1 V_{PP}) or 9-pin (TTL), and 3-pin mini-DIN connector (female) For connecting the **XYZ encoders** and the **foot switch** to the IK 5000			
	For 3 axes XYZ and foot switch	540550-40	540550-10
	For 2 axes XY and foot switch	540540-24	540540-05
Complete with D-sub connector (female), 15-pin (1 V_{PP}) or 9-pin (TTL) For connecting the **Q encoder** to the IK 5000		540541-24	540541-05

MSE 1000 evaluation electronics

The modules of the MSE 1000 evaluation unit feature D-sub connectors or M12 plug connectors for connecting encoders and for external operation.

	MSE 1114	MSE 1124	MSE 1184	MSE 131x	MSE 132x	MSE 1332	MSE 1358	MSE 138x
Encoders							–	
1 V_{PP}	–	–	4	–	–	–	–	4 or 8
TTL	–	4	–	–	4 or 8	–	–	–
EnDat 2.2	4	–	–	4 or 8	–	–	–	–
Analog ±10 V	–	–	–	–	–	2[1]	–	–
Analog 4 mA to 20 mA	–	–	–	–	–	2	–	–
LVDT or HBT[2]	–	–	–	–	–	–	8	–
Foot switch	●	●	●	–	–	–	–	–

[1] Selectable
[2] Please note when ordering

	MSE 1401	MSE 1501
Switching input	4 TTL	–
Switching output	4 relays	–
Compressed air	–	●

EIB 700, IK 220 evaluation units

The EIB 700 and IK 220 evaluation units feature D-sub connectors for connecting encoders and for external operation.

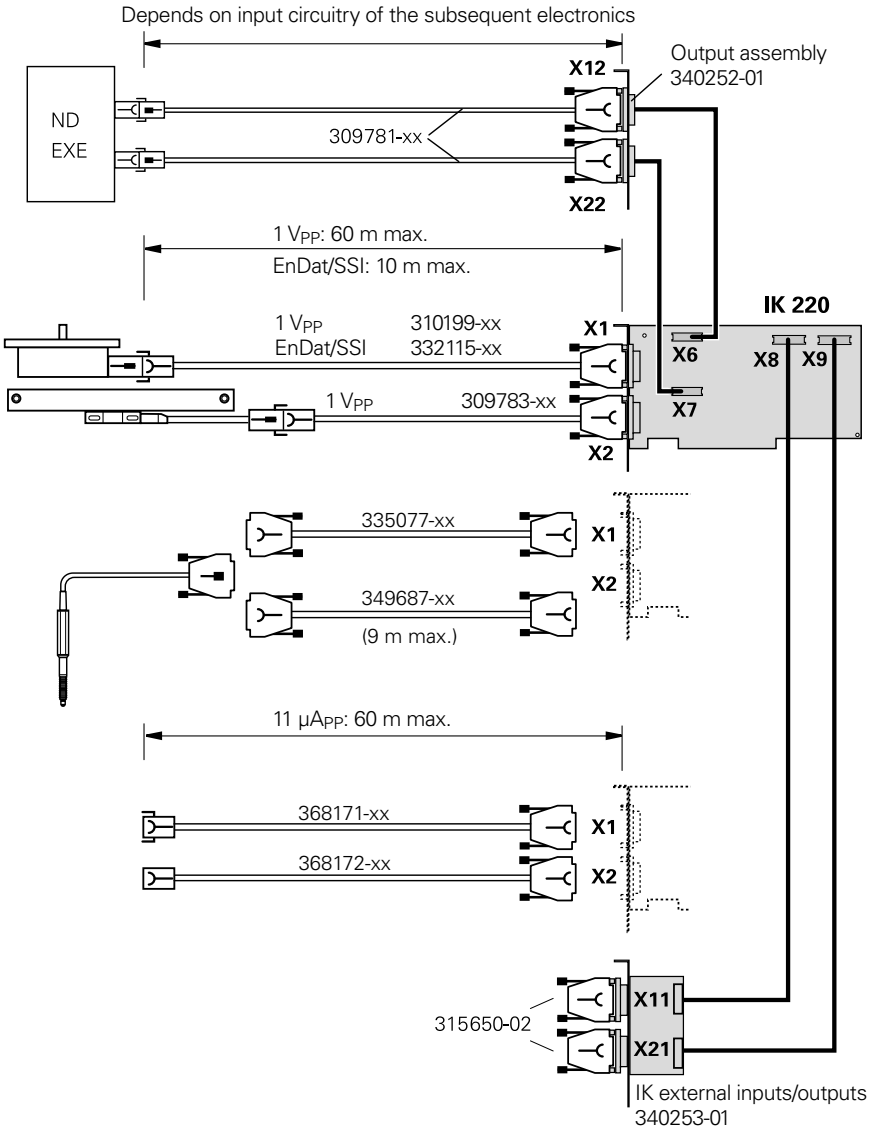
With the IK 220, the encoder signals can be conducted out over an additional slot cover. They are available as 11 µA current signals for further processing in evaluation electronics or EXE pulse-shaping electronics. A further slot cover contains the connections for the external inputs/outputs, e.g. for storing the measured values.

	EIB 700	**IK 220**
Encoder inputs		
1 V_{PP}	4[1)]	2[1)]
11 μA_{PP}	4[1)] Upon request	2[1)]
EnDat 2.1	4[1)]	2[1)]
EnDat 2.2	4[1)]	–
SSI	–	2[1)]
Encoder outputs		
11 μA_{PP}	–	2 (optional assembly)
Trigger input	4	2 (optional assembly)
Trigger output	4	2 (optional assembly)
PLC inputs/outputs	4/4[2)]	2/–

[1)] Selectable [2)] Can also be used as a trigger or logical input or output

Accessories
External inputs/outputs for IK 220
Slot cover with two D-sub connections (9-pin) male
ID 340253-01

Output assembly for IK 220
Slot cover with two D-sub connections (9-pin), male, for leading the encoder signals (11 µApp) to the subsequent electronics.
ID 340252-01

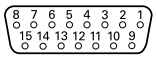


Encoders

Evaluation units feature interfaces for connecting HEIDENHAIN encoders. Other interfaces are available upon request. A distribution cable is necessary in order to attach the encoders to the IK 5000.

Pin layout ~ 1 V_{PP}

15-pin D-sub flange socket (female)

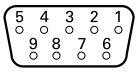


	Power supply voltage				Incremental signals						Others
	4	**12**	**2**	**10**	**1**	**9**	**3**	**11**	**14**	**7**	**5/6/8/ 13/15**
~ 1 V_{PP}	**U_P**	**Sensor** U_P	**0 V**	**Sensor** 0 V	**A+**	**A–**	**B+**	**B–**	**R+**	**R–**	**/**

Cable shield connected to housing; **U_P** = Power supply voltage
Sensor: The sensor line is connected in the encoder with the corresponding voltage supply.
Vacant pins or wires must not be used!

Pin layout ⊓⊔ TTL

9-pin D-sub flange socket (female)

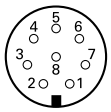


	Power supply		Incremental signals						Others
	7	**6**	**2**	**3**	**4**	**5**	**9**	**8**	**1**
⊓⊔ TTL	**U_P**	**0 V**	**U_{a1}**	**$\overline{U_{a1}}$**	**U_{a2}**	**$\overline{U_{a2}}$**	**U_{a0}**	**$\overline{U_{a0}}$**	**/**

Cable shield connected to housing; **U_P** = Power supply voltage
Vacant pins or wires must not be used!

Pin layout of ND 2100G and MSE 1000 EnDat

8-pin flange socket, M12



	Power supply				Position values			
	8	**2**	**5**	**1**	**3**	**4**	**7**	**6**
	U_P	**Sensor** U_P	**0 V**	**Sensor** 0 V	**DATA**	**$\overline{DATA}$**	**CLOCK**	**$\overline{CLOCK}$**

Cable shield connected to housing; **U_P** = Power supply voltage
Sensor: The sensor line is connected in the encoder with the corresponding power line.
Vacant pins or wires must not be used!

Pin layout of series ND 200 ∿ 1 V_{PP}/∿ 11 μA_{PP}/EnDat

15-pin D-sub flange socket (female)

	Power supply					Incremental signals						Position values			
	4	**12**	**2**	**10**	**6**	**1**	**9**	**3**	**11**	**14**	**7**	**5**	**13**	**8**	**15**
∿ 1 V_{PP}	**U_P**	**Sensor** U_P	**0 V**	**Sensor** 0 V	**/**	**A+**	**A–**	**B+**	**B–**	**R+**	**R–**	**/**	**/**	**/**	**/**
∿ 11 μA_{PP}					**Internal shield**	**I_{1+}**	**I_{1-}**	**I_{2+}**	**I_{2-}**	**I_{0+}**	**I_{0-}**	**/**	**/**	**/**	**/**
EnDat						**/**	**/**	**/**	**/**	**/**	**/**	**DATA**	**$\overline{DATA}$**	**CLOCK**	**$\overline{CLOCK}$**

Shield on housing; **U_P** = Power supply voltage
Sensor: The sensor line is connected in the encoder with the corresponding power line.
Vacant pins or wires must not be used!

Pin layout of EIB 700 series ∿ 1 V_{PP}

15-pin D-sub flange socket (female)

	Power supply				Incremental signals[1)]						Others		
	4	**12**	**2**	**10**	**1**	**9**	**3**	**11**	**14**	**7**	**8**	**6**	**5/13/15**
∿ 1 V_{PP}	**U_P**	**Sensor** U_P	**0 V**	**Sensor** 0 V	**A+**	**A–**	**B+**	**B–**	**R+**	**R–**	**L1**[1)]**/H**[2)]	**L2**[1)]**/L**[2)]	**/**

Shield on housing; **U_P** = Power supply voltage
Sensor: The sensor line is connected in the encoder with the corresponding power line.
Vacant pins or wires must not be used!
[1)] For LIDA 4xx
[2)] For LIF 4xx

Pin layout of EIB 700 series, EnDat

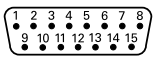
15-pin D-sub flange socket (female)

	Power supply					Incremental signals				Position values				Others
	4	**12**	**2**	**10**	**6**	**1**	**9**	**3**	**11**	**5**	**13**	**8**	**15**	**7/14**
EnDat	**U_P**	**Sensor** U_P	**0 V**	**Sensor** 0 V	**Internal shield**	**A+**	**A–**	**B+**	**B–**	**DATA**	**$\overline{DATA}$**	**CLOCK**	**$\overline{CLOCK}$**	**/**

Shield on housing; **U_P** = Power supply voltage
Sensor: The sensor line is connected in the encoder with the corresponding power line.
Vacant pins or wires must not be used!
[1)] For encoders with ordering designations EnDat01 and EnDat02

Pin layout of IK 220

15-pin D-sub flange socket (male)

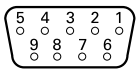


	Power supply					Incremental signals						Position values			
	1	**9**	**2**	**11**	**13**	**3**	**4**	**6**	**7**	**10**	**12**	**5**	**8**	**14**	**15**
11 µA$_{PP}$	**U_P** 5 V	**Sensor** 5 V	**U_N** 0 V	**Sensor** 0 V	**Internal shield**	**I_1 +**	**I_1 –**	**I_2 +**	**I_2 –**	**I_0 +**	**I_0 –**	**/**	**/**	**/**	**/**
1 V$_{PP}$						**A+**	**A–**	**B+**	**B–**	**R+**	**R–**	**/**	**/**	**/**	**/**
EnDat SSI						**A+**	**A–**	**B+**	**B–**	**/**	**/**	**DATA**	**$\overline{\text{DATA}}$**	**CLOCK**	**$\overline{\text{CLOCK}}$**

Shield on connector housing
Vacant pins or wires must not be used!

Pin layout of MSE 1000, analog

Mating connector:
9-pin D-sub flange socket (female)



	Power supply 1			Power supply 2		Shield		Analog signal		
	1	**4**	**3**	**9**	**6**	**5**	**housing**	**8**	**2**	**7**
	– 12 V	**+ 12 V**	**0 V**	**5 V**	**0 V**	**Shield**	**Chassis ground**	**U_A**	**I_A**	**$\overline{I_A}$**

U_A: Analog voltage signal – 10 V to + 10 V; **I_A:** Analog current signal 4 mA to 20 mA

Cable shield connected to housing; **U_P** = Power supply voltage
Sensor: The sensor line is connected in the encoder with the corresponding power line.
Vacant pins or wires must not be used!

Switching inputs/outputs ND 287

Switching inputs

The ND 287 evaluation unit features many inputs for external operation and outputs for switching functions. The input can respond by pulse or make contact.
Exception: The switching inputs for transmitting measured values over the data interface are separate for contact and pulse.

The switching input E is active when a Low signal U_L is applied (contact or pulse to 0 V).

Signal level
– 0.5 V ≤ U_L ≤ 0.9 V with I_L ≤ 6 mA
3.9 V ≤ U_H ≤ 15.0 V
t_{min} ≥ 30 ms

Zero reset/preset
Each axis can be set by an external signal to the display value zero or to a value stored in a parameter (SET).

External control of measurement series Switching the display between MIN, MAX or DIFF
With a continuously applied Low signal at the corresponding switching input you activate the external control of measurement series. Starting a measurement series and switching to the MIN/MAX/DIFF display are controlled externally over additional switching inputs.

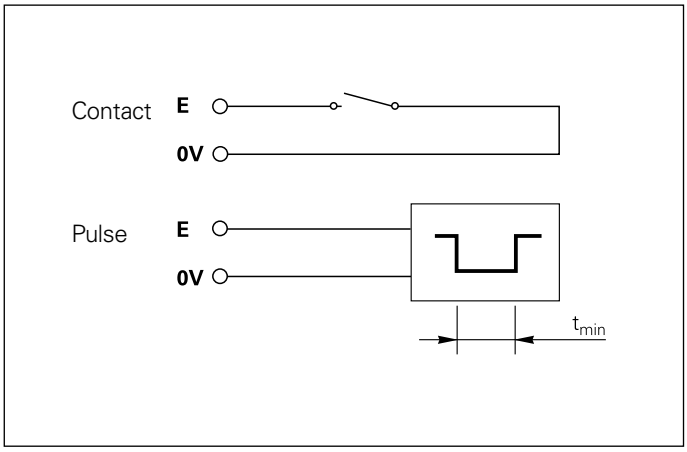
Ignoring reference mark signals
(disabling the reference pulse)
When the input is active, the readout ignores all reference mark signals. A typical application is for linear measurement through the lead screw and a rotary encoder.

Activating or deactivating REF mode
After switch-on or a power interruption, the digital readout can be switched externally to REF mode. The next signal then deactivates REF mode (switchover function).

Display with axis coupling
As an option, the ND 287 can have two encoder inputs. Using switching inputs, you can switch the display to individual measured values, sum, difference or any logical operation.

	ND 287
12 switching inputs	Reset, clear error message Set datum Ext. control of measurement series or display of X1[1)] Start measurement series or display of f (X1, X2)[1)] Display minimum MIN or display of X2[1)] Display maximum MAX or display of X1 + X2[1)] Display maximum DIFF or display of X1 + X2[1)] Measured value output (pulse) Measured value output (contact) Ignore reference mark signals (input X1) Ignore reference mark signals (input X2) Activating or deactivating REF mode
6 switching outputs	Display value is zero Measured value switching limit A1 Measured value ≤ switching limit A2 Measured value > upper sorting limit Measured value < lower sorting limit Error

[1)] Also selectable by parameter

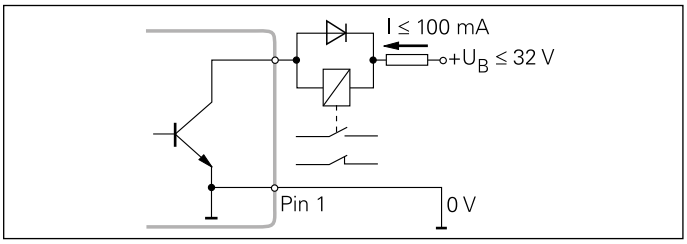


Switching outputs

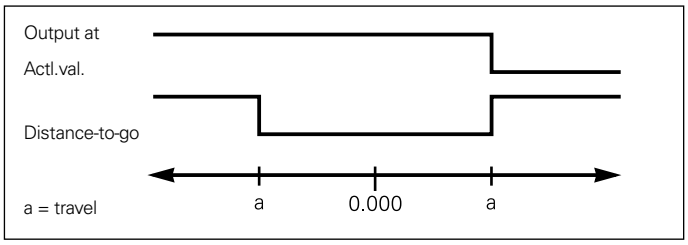
The ND 287 features open-collector outputs that switch to 0 V (= active Low).

Delay of signal output:
$t_V \leq 20$ ms

Signal level
$U_L \leq 0.4$ V with $I_L \leq 100$ mA
$U_H \leq 32$ V with $I_H \leq 10$ µA

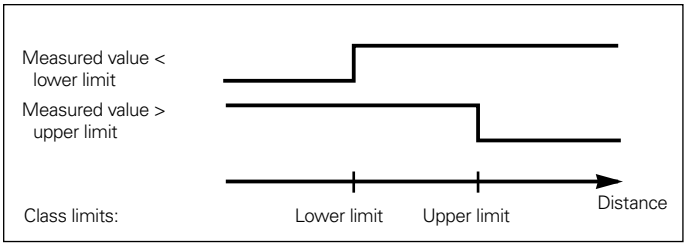


Trigger points (in actual value mode)
When the measured value reaches trigger points defined by parameter, the corresponding output becomes active. Up to two trigger points can be defined.

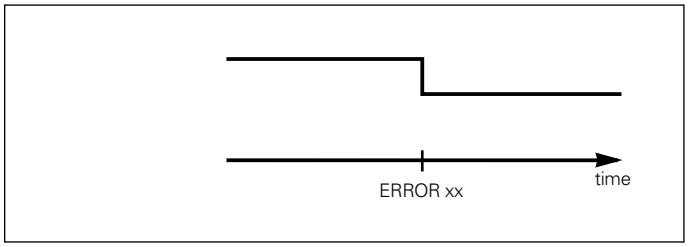


Switch-off ranges (in distance-to-go mode)
In the distance-to-go mode the trigger points function as switch-off ranges. They are located symmetrically around the display value 0.

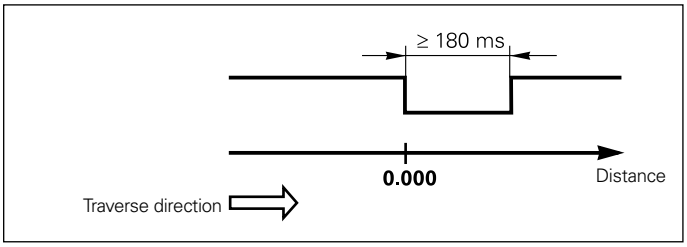
Sorting limits
When the measured value exceeds the limits defined via parameters, the corresponding outputs become active.



Trigger signal for error
The ND 200 series readouts constantly monitor the measuring signals, the input frequency, the data output, etc. for errors, and report errors as they occur with error messages. If errors occur that may distort the measurement or corrupt the data, the readout activates a switching output. This feature allows monitoring of automated processes.



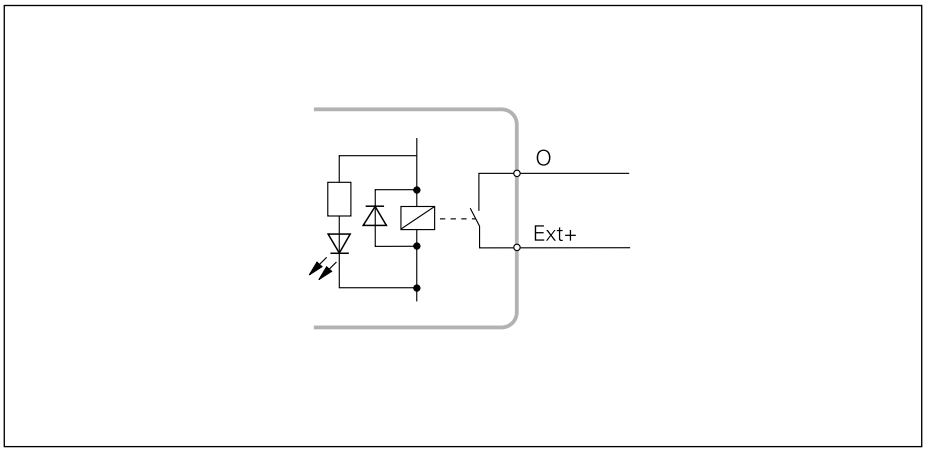
Zero crossover
At the display value "zero", the corresponding output becomes active. The minimum signal duration is 180 ms.



MSE 1000 inputs/outputs

Relay outputs

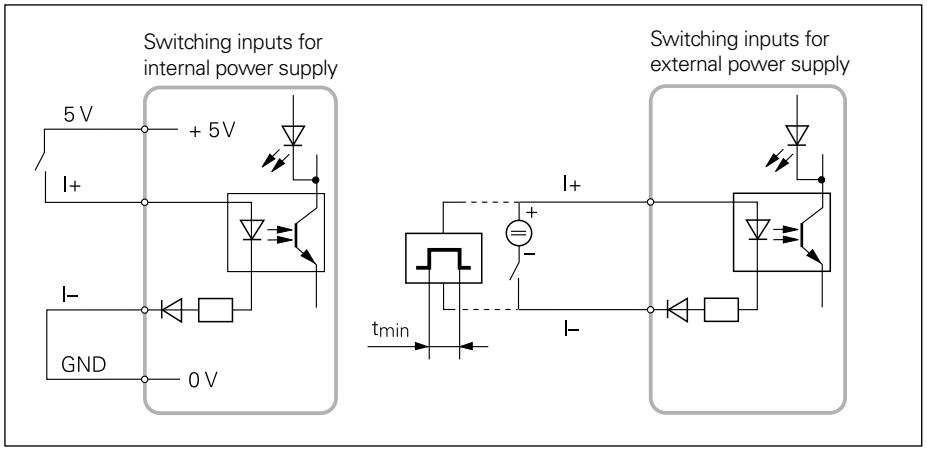
Specifications
U_L ≤ 30 V DC/AC
I_L ≤ 0.05 A
t_D ≤ 25 ms



Switching inputs

The switching inputs are active when a High signal (contact or pulse) is present. They are isolated and can be supplied externally or internally.

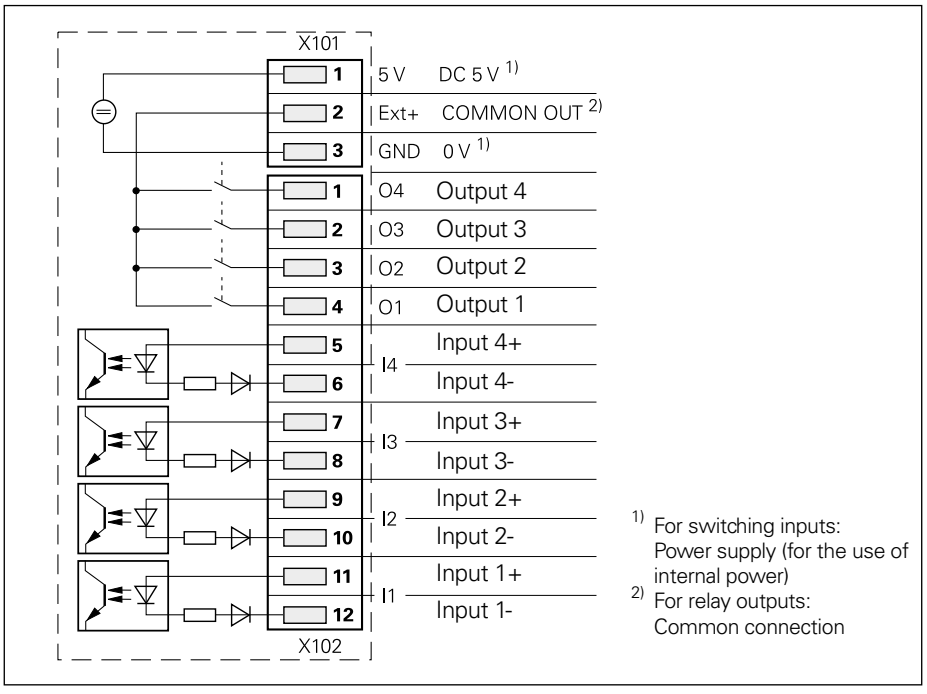
Specifications
0 V ≤ U_L ≤ 1.5 V
4.5 V ≤ U_H ≤ 26 V
I_L ≤ 25 mA
t_{min} ≥ 100 ms



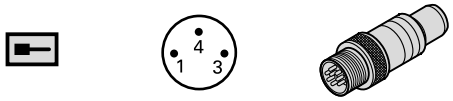
Relay outputs and switching inputs are integrated in the MSE 1401 input/output module.
It is available in two versions.

IP 40 protection Electrical connections as terminals
IP 65 protection Electrical connections as individual M8 connecting elements

IP 40 terminal block

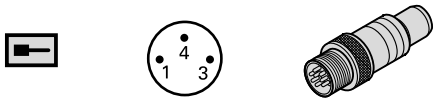

X101
1 5 V DC 5 V 1)
2 Ext+ COMMON OUT 2)
3 GND 0 V 1)
1 O4 Output 4
2 O3 Output 3
3 O2 Output 2
4 O1 Output 1
5 I4 Input 4+
6 Input 4-
7 I3 Input 3+
8 Input 3-
9 I2 Input 2+
10 Input 2-
11 I1 Input 1+
12 Input 1-
X102
1) For switching inputs: Power supply (for the use of internal power)
2) For relay outputs: Common connection

IP 65 relay outputs
Mating connector for MSE 1401 (IP 65)
3-pin M8 coupling (female)
ID 1071953-01



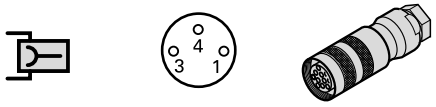
PIN	Assignment	
1	O	Output
3	Vacant	
4	Vacant	

IP 65 relay inputs
Mating connector for MSE 1401 (IP 65)
3-pin M8 coupling (female)
ID 1071953-01



PIN	Assignment	
1	I+	Entrance
4	I–	
3	Vacant	

IP 65 power supply
Mating connector for MSE 1202 and MSE 1401 (IP 65)
3-pin M8 connector (female)
ID 1071955-01

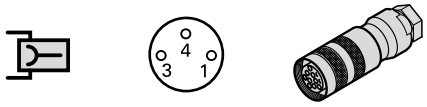


PIN	Assignment	
1	5 V DC	*For switching inputs:* Power supply (for the use of internal power)
4	0 V	
3	COMMON OUT	*For relay outputs:* Common connection

Supply unit

The MSE 1202 power-supply module with 24 V DC has an M8 connection

Mating connector
3-pin M8 connector (female)



PIN	Assignment	
1	24 V DC	Voltage supply
3	0 V	
4	Vacant	

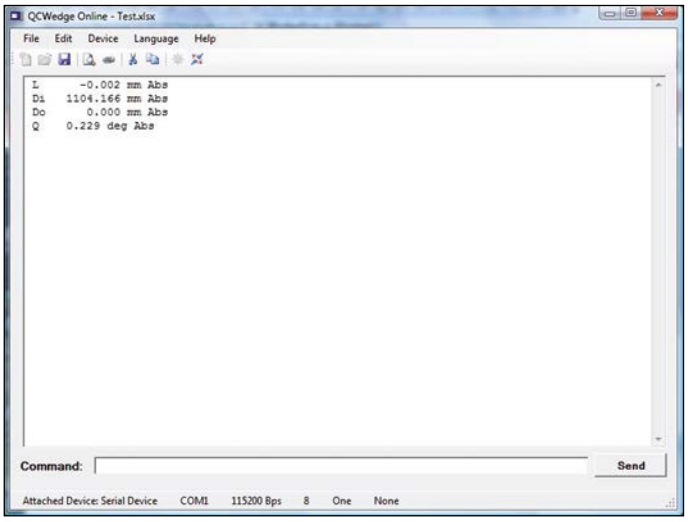
Software
QUADRA-CHEK Wedge

QUADRA-CHEK Wedge software
For communication between the
ND 280, 287/ND 1000/ND 2000 and PC
ID 709141-01

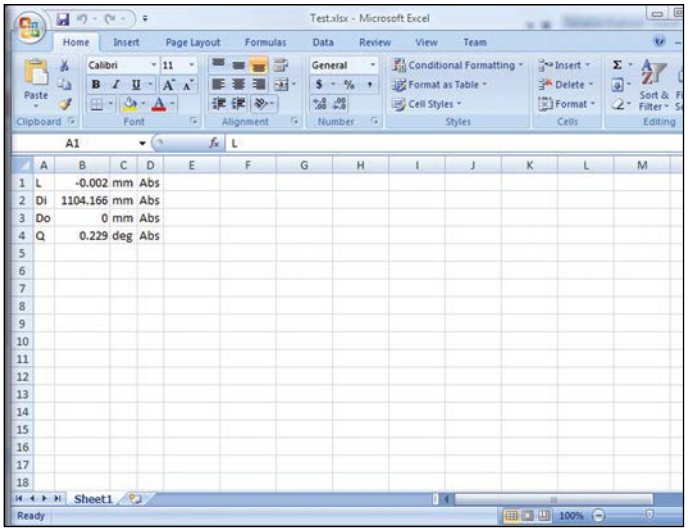
The QUADRA-CHEK Wedge software simplifies communication between an ND 280, 287/ND 1000/ND 2000 and a Windows-based PC. The measured values are transmitted from the evaluation unit to the PC via a RS-232-C connection, and are written directly to an Excel table, where the data can be edited, saved and printed. A suitable RS-232-C cable* is included with QUADRA-CHEK Wedge (cable length: 3 m).

* Cable not suitable for ND 28x

System requirements
- Windows XP, Vista, 7 or 8 (32-bit/64-bit)
- Internet Explorer 6.0 or higher
- Excel 2003 or later
- Windows user rights: Administrator


QCWedge Online - Test.xlsx
File Edit Device Language Help
L -0.002 mm Abs
Di 1104.166 mm Abs
Do 0.000 mm Abs
Q 0.229 deg Abs
Command:
Send
Attached Device: Serial Device COM1 115200 Bps 8 One None

The values acquired by the evaluation electronics are transmitted to the PC ...



... and can be saved in an Excel table.

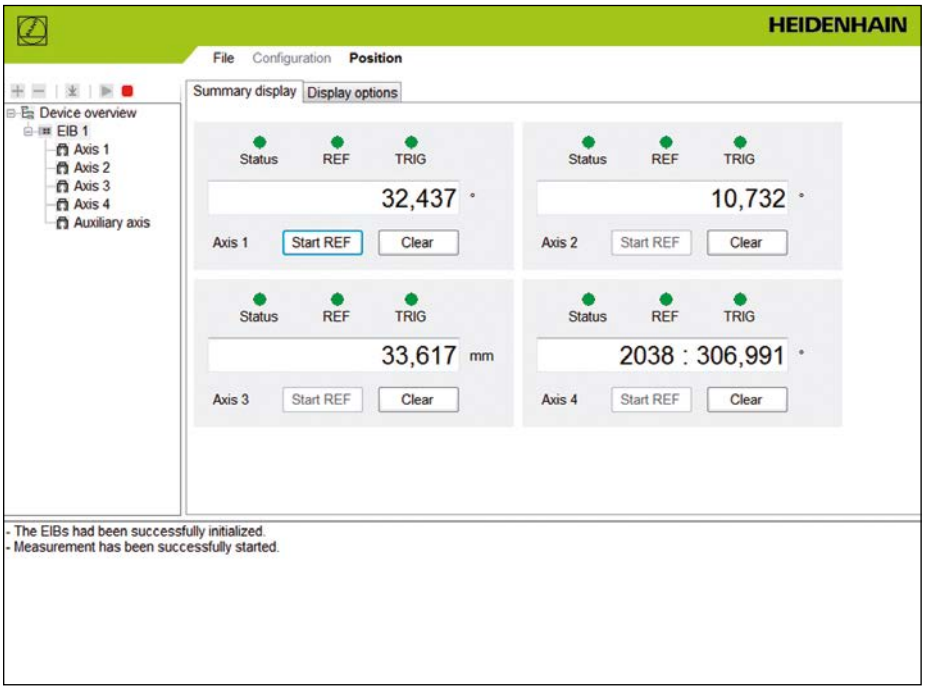
EIB 700 application software

The EIB application software covers two applications:

Commissioning and demonstration of the EIB 700

- Easy configuration of settings required for operation of the EIB 700 (e.g. input interface, data packets, operating mode, trigger settings).
- Management of one or more EIB 700 units.
- Simple representation of the positions transmitted by the EIB 700.
- Settings can be saved so that different application projects can be managed.

The user's guide provides more information.



Platform for customer applications

The EIB application software is made available in the source code. Based on this application, customers can quickly realize their own applications. The application software was programmed with C++/CLI and Windows Forms in Visual Studio 2008. This programming environment is widely used in technical application programming, but does not necessarily provide state-of-the-art operating techniques like those in Windows 7, for example. However, the customer can adapt the program to other graphic user interfaces.

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